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EXPLORATION OVERVIEW

Mining, Exploration and Geological Investigations

NORTHWEST TERRITORIES 1986

GEOLOGY DIVISION
NORTHERN AFFAIRS PROGRAM
YELLOWKNIFE N.W.T
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NWT EXPLORATION OVERVIEW, 1986
NORTHERN AFFAIRS PROGRAM, GEOLOGY DIVISION
YELLOWKNIFE, NORTHWEST TERRITORIES

PART 1 - Mining and Exploration Overview-1986

A SUMMARY OF MINING AND MINERAL EXPLORATION IN THE NWT, 1986

W.A. PADGHAM,
CHIEF GEOLOGIST

The level of exploration for base metals and uranium in 1986 remained comparable to that of the previous year.

Urangesellschaft, PNC (Power Nuclear Corporation of Tokyo) and CEGB (Central Electric Generating Board) had important uranium programs underway. Total expenditures were close to $5 million.

Base metal exploration was mainly confined to areas adjacent to or within the producing mines: Pine Point, Polaris and Nanisivik. The Government of Canada sold its interest in Nanisivik to Mineral Resources International. Poor financial performance at Pine Point Mines (the mine operated at a loss during the year) may result in closure of operations in 1987.

Canada Tungsten closed the Cantung Mine because of continued low prices and oversupply. Procan Resources appears to have gained control of the Prairie Creek (Cadillac) silver-base metal deposits, but there is little likelihood this operation will start up given present metal prices.

Staking of ultramafic rocks for platinum group elements (PGE) provided a new thrust in exploration. Claims now cover the Muskox Intrusion, where one diamond drill program was conducted; the Duck Lake sill, east of Yellowknife; the Rankin Inlet copper-nickel deposit; and areas adjacent to Canico's Ferguson Lake nickel-copper deposit in south-central Keewatin. Drilling on the Ni-Cu showings found a few years ago on Rutledge Lake was probably encouraged by the PGE potential of those showings.

Highwood Resources and Hecla Mining joined forces to develop the Thor Lake beryllium-rare earth deposits.

Pamour Porcupine purchased the Falconbridge interest in Giant Yellowknife Mines Ltd. and began a major corporate restructuring. Cominco put the Con Mine up for sale, and it was bought by Nerco Minerals Co. of Alaska at the end of November. Cominco itself has been sold by the CPR.

Gold was the major bright spot in mining and exploration as significant gold price rises during the year sparked higher interest in the yellow metal.

The Bullmoose, Tom and Giant Bay gold properties were explored underground and drilling continued on Echo Bay's Indin Lake deposits (Lex and Cass) and on Noranda/Getty's "Tundra Project" property. Canuc Resources drilled more holes on their Coronation Gulf property. Aber Resources obtained good grades and widths in drilling on the BUGOW property which is strategically situated just north of Fort Rae.

Cominco, Back River Joint Venture, Bow Valley and many junior companies, including Silver Hart and Welcome North, explored for iron formation-hosted deposits in the extensive turbidite domains in the central and northeastern Slave Province, and Utah Mines worked in many parts of the Slave.

The gold search intensified also in the Keewatin where Asamera, Borealis and Comaplex were active.

Expenditures on gold exploration in the NWT probably exceeded $25 million during 1986 and more than 80% of this was in the Slave Structural Province.

PROPERTY ACQUISITION

A total of 360,388 ha of land were staked in 1986; a 5-year record and an increase of 64% relative to 1985. About 80% of the staked ground was in the Mackenzie District (mainly in the Slave Structural Province) and about 20% in the Keewatin District. The principle target in both areas is gold. There was no staking in the Cordilleran (Nahanni) District and very little in the other mining districts of the NWT.

Prospecting permits issued since 1978 in the various geological regions of the NWT are summarized in Table 1. Most of the 31, permits issued in 1986 cover gold explorations plays in the Churchill Province (Keewatin District) and are held by Comaplex Resources Ltd and Borealis Ltd.

TABLE 1: PROSPECTING PERMITS ISSUED 1978 TO 1986, IN VARIOUS GEOLOGICAL PROVINCES

AREA / YEAR	78	79	80	81	82	83	84	85	86
ARCTIC ISLANDS	10	0	10	2	53	87	10	15	3
CORDILLERAN PROVINCE	5	1	11	9	12	7	0	0	0
CHURCHILL PROVINCE	50	72	57	54	17	1	10	11	26
BEAR PROVINCE	10	26	17	4	3	0	0	5	2
SLAVE PROVINCE	0	0	3	4	6	1	5	22	0
TOTALS	75	99	98	73	91	96	25	53	31

EXPLORATION SUMMARY

A preliminary estimate of NWT exploration level shows that at least 50 companies conducted 104 exploration projects in 1986. Table 2 summarizes the distribution of these projects in the various geological provinces and subprovinces. Table 3 is a breakdown of exploration projects according to the commodities sought. The emphasis on

gold exploration is obvious. Table 4 tallies the number of higher cost projects involving drilling and underground development. Producing mines are added as higher cost projects in Table 4 but are excluded from Tables 2 and 3.

TABLE 2: COMPARISON OF ACTIVITY IN VARIOUS GEOLOGICAL PROVINCES AND SUBPROVINCES

GEOLOGICAL REGION	NUMBER OF PROJECTS EACH YEAR								
YEAR	78	79	80	81	82	83	84	85	86
CORDILLERA	14	21	29	24	12	11	11	7	3
ARCTIC ISLANDS*	8	4	7	24	16	11	17	13	3
KEEWATIN +	36	48	53	59	34	25	19	17	21
SE-MACKENZIE +	7	13	14	25	10	11	9	3	1
EAST ARM	7	6	4	14	3	1	1	2	2
PINE POINT	7	6	6	6	3	2	1	2	1
BEAR PROVINCE	32	32	22	24	10	11	2	3	3
SLAVE PROVINCE	29	33	29	42	25	44	57	92	70
TOTALS	140	162	164	218	113	116	117	139	104

* Includes Baffin Island and Melville Peninsula, part of the Churchill Province, as well as the Arctic Archipelago.

+ Parts of the Churchill Structural Province.

TABLE 3: EXPLORATION BY TARGET COMMODITY

COMMODITY	AGE OF MAIN HOST ROCKS (GEOLOGICAL PROVINCE)	YEAR 83	84	85	86
GOLD	ARCHEAN (SLAVE & KAMINAK SUBPROV) (PLACER IN NAHANNI)	53	77	95	85
URANIUM	PROTEROZOIC (BEAR & CHURCHILL)	25	16	8	6
SILVER	PROTEROZOIC (BEAR)	9	3	4	0
BASE METALS	ALL AGES	19	15	10	5
RARE METALS	ARCHEAN/PROTEROZOIC/CRETACEOUS (SLAVE-BEAR-NAHANNI (CORDILLERA))	7	3	15	3
COAL	CRETACEOUS/TERIARY	1	1	0	0
MISCELLANEOUS	(PGE: SLAVE & KEEWATIN)	1	1	7	5
TOTALS		115	116	139	103

TABLE 4: HIGH COST PROJECTS (DRILLING, MINE DEVELOPMENT)

	YEAR 78	79	80	81	82	83	84	85	86
DRILLING	52	61	81	58	45	54	29	35	26
UNDERGROUND DEVELOPMENT	2	4	6	12	5	8	4	3	3
PRODUCTING MINES	7	8	9	11	12	12	11	9	8
TOTALS	61	73	96	81	62	74	44	47	37

GEOLOGY DIVISION (NAP) FUNCTIONS AND ACTIVITIES

The Northern Affairs Program of INAC is responsible for the administration of all mineral resources in the NWT excluding oil and gas. The Geology Division, under this authority, acts much as a Provincial Geological Survey.

To fulfill its mandate the Geology Division:

1. Maintains a geological data base to assist in the furtherance of mineral exploration and development.

2. Monitors mining and mineral exploration.

3. Reviews technical assessment work submitted to the Mining Lands Division.

4. Provides advice and assistance to individuals or organizations interested in NWT mineral resources and geology.

5. Expands geological knowledge of the NWT, its mineral deposits and mineral potential.

The division budget to pursue these goals has been approximately $1.3 million, and is made up of: salaries $703,000, for 12 permanent employees; capital of $135,000; operating funds of $600,000; and minor funds received under special programs for summer student employment.

GEOLOGY DIVISION 1986 PROJECTS

1. RUSSELL LAKE 85 J/13, 85 O/3,4

Mapping supracrustals that host iron formation gold deposits. First year of a multi-year detailed mapping project under direction of Project Geologist, V. Jackson.

2. HOOD RIVER 75 L/9,10,15,16

Mapping southern extension of the High Lake Volcanic Belt. Continuation of a long term project under direction of Project Geologist, V. Jackson.

3. SURFICIAL MAPPING

Russell Lake and Hood River areas and end-glacial marine sediments of the Arctic coast (Paulatuk to Spence Bay). Continuation of a long term project under direction of D. Kerr, at the University of Alberta.

4. HOPE BAY 77 A

Detailed mapping of ultramafic sills and basaltic volcanics in the Hope Bay Volcanic Belt. W.A. Gibbins, Arctic Islands District Geologist.

5. OCTOPUS FORMATION 85 J/7,8

Completion of mapping of south end of Yellowknife Volcanic Belt. K. Pelletier, Carleton University.

6. ELLINGTON LAKE 86 E/11

Mapping of a Bear Province supracrustal (mainly volcanic) belt. K. Pelletier, Carleton University.

7. JACKFISH ISLAND 85 J/1,8

1:10,000 mapping of Yellowknife Bay area, southeast end of Yellowknife Volcanic Belt (Duck and Burwash Formations). D. Roach, Carleton University.

8. CAMERON RIVER VOLCANIC BELT 85 I/15

Detailed (1:10,000) mapping to elucidate structure and stratigraphy of this area and adjacent parts of the Slave Province. R. Cullen, Carleton University.

9. CAMERON RIVER VOLCANIC BELT/SLEEPY DRAGON METAMORPHIC COMPLEX 85 I/15

Structural mapping of the relations of volcanics of the Yellowknife Supergroup to the basement complex. T. Kusky, John Hopkins University; W. Kidd, SUNY, Albany; and C.Issachsen, Washington University, St. Louis.

10. POINT LAKE AREA (KESKARRAH BAY) 86 H/7

Structural mapping of the relations of volcanics of Yellowknife Supergroup to the basement complex. T. Kusky, John Hopkins University; W. Kidd, SUNY, Albany; C. Issachsen ,Washington University, St. Louis.

11. KAM/BANTING TRANSITION

Completion of a study of the transition from the Kam Group to the Banting Group and the relation of the Jackson Lake Formation to these groups. G. Bailey, Queen's University.

12. WESTERN PLUTONIC COMPLEX

1:50,000 mapping of granitoids along the west side of the Yellowknife Volcanic Belt to investigate the granite/gold connection. First year of a long term project by D. Atkinson, University of Western Ontario.

13. NONACHO BASIN

1:50,000 mapping of extensions of Nonacho Group and collection of material for heavy mineral analysis and gold content. Dr. L. Aspler, Carleton University.

14. GOLD VEIN STUDIES YELLOWKNIFE BASIN

Detailed mapping of gold quartz veins in the Burwash Formation. J.A. Brophy, District Geologist, Northern Affairs Program; W.K. Fyson, University of Ottawa.

15. DEFORMATION STUDIES YELLOWKNIFE BASIN

Detailed studies to clarify structural relations in the Slave Province. W.K. Fyson, University of Ottawa.

16. DATING BEAR PROVINCE

Geochronological studies in Wopmay Orogen. S.A. Bowring, Washington University, St. Louis, in association with Dr. R. Hildebrand, GSC, Ottawa.

17. DATING SLAVE PROVINCE

Geochronological studies in many parts of Slave Stuctural Province to improve maps and relate the mineral deposits to structural events. W.A. Padgham, Chief Geologist, Northern Affairs Program; in cooperation with S.A. Bowring, R.I. Thorpe, GSC, Ottawa.

18. MINERALOGICAL STUDIES, THOR LAKE

Mineralogical studies of minerals of the Thor Lake rare metal deposits. D.W.G. Smith, University of Alberta.

19. PINE POINT MINES

Geology and mineralogy of N-81 ore body, Pine Point Mines. by S. Foster under direction of R.D. Morton, University of Alberta.

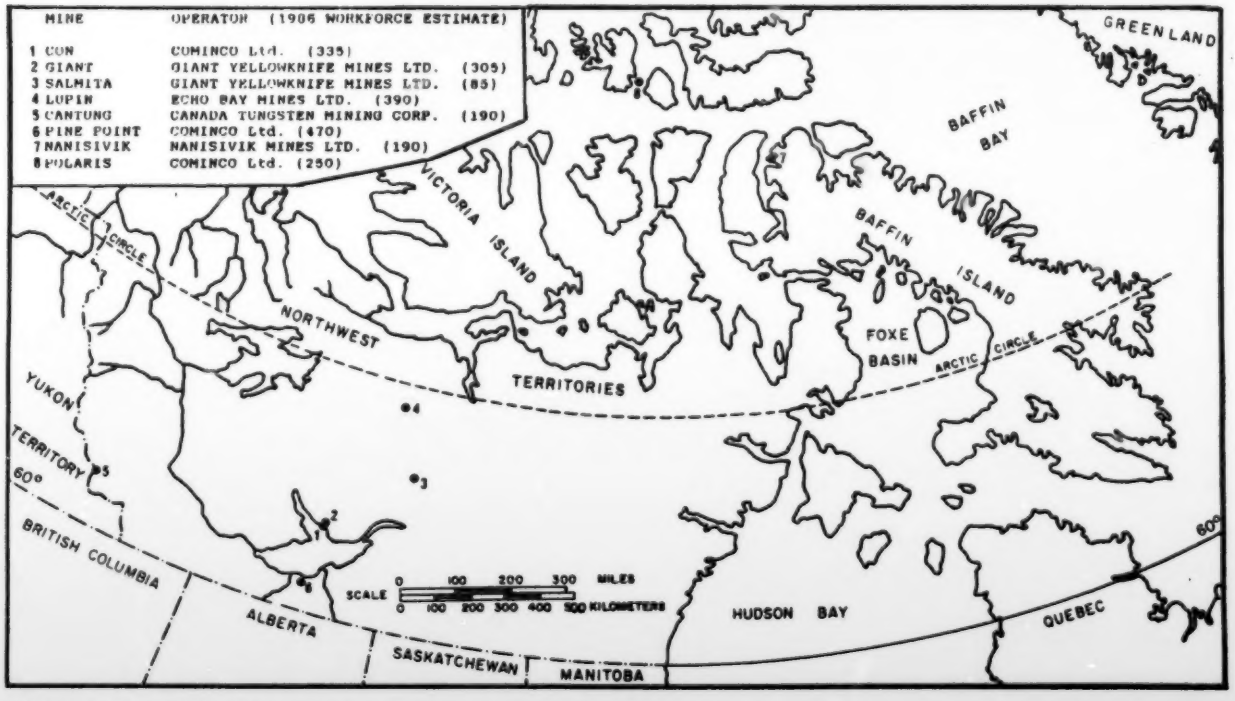

FIGURE 1: Operating Mines in the Northwest Territories during 1986

OPERATING MINES

C.E. ELLIS
STAFF GEOLOGIST

Eight mines operated in the Northwest Territories in 1986 (Figure 1). Mine production figures are given in Table 5 and NWT metal production figures in Table 6.

Cominco was sold by Canadian Pacific Ltd. to a consortium comprising Teck Corp. of Vancouver, Metallgesellschaft (Canada) Ltd. and MIM (Canada) Ltd., both of Toronto.

GOLD

Pamour Porcupine purchased the Falconbridge interest in GIANT YELLOWKNIFE MINES. Production was from Giant Mine, the open pit and the U.B.C. and G.K.P. zones.

CON MINE was sold by Cominco Ltd. to Nerco Minerals of Alaska in December. No surface exploration was done on the mine lease because of the sale. Underground exploration comprised 36,756 m of diamond drilling in 237 holes and 83.6 m of drift development.

Development work at LUPIN MINE confirmed the extension of the centre zone at a depth of 650 m.

LEAD-ZINC

POLARIS MINE was closed for the month of July and will reduce operations over Christmas.

Exploration plans for the PINE POINT MINE area were suspended in March because of financial constraints. An exploration program started in May, after Pine Point Mines Ltd. arranged for $2 million funding from flow-through shares. High grade deposits were mined during the year. Plans to close the mine in mid-1987 have been announced.

The Federal Government sold its 18% equity interest in NANISIVIK MINES LTD.

TUNGSTEN

Production at CANTUNG MINE ceased on May 20, 1986 because of a labour dispute. On August 12, 1986 Cantung closed, primarily because of steadily decreasing tungsten prices.

TABLE 5: Production from Operating Mines in the Northwest Territories, 1986:

MINE	Commodity	Milled 1985	Production 1985	Reserves January '86	Milled 1986 *	Production 1986 *
Con	Au (Ag) (As_2O_3)	198 kt	2427 kg Au 1100 t As_2O_3	1360.8 kt 13.7 g/t Au	198 kt^	2777 kg Au^ 574 kg Ag
Giant	Au (Ag) As_2O_3	300 kt	2030 kg Au	909.9 kt 8.2 g/t Au	290 kt^	2238 kg Au^ 778 kg Ag
Salmita	Au (Ag)	65 kt	1981 kg Au	58 kt 33.3 g/t Au	63 kt	1530 kg Au 246 kg Ag
Lupin	Au (Ag)	545 kt	6069.3 kg Au	3141.3 kt 12.2 g/t Au	600 kt	5900 kg Au 980 kg Ag
Nanisivik	Zn, Pb (Ag)	696 kt	106.9 kt Zn 7.9 kt Pb 22,900 kg Ag	2925 kt ** 9.9% Zn, 0.3% Pb, 40 g/t Ag	685 kt	59 kt Zn 3.7 kt Pb 24,947 kg Ag
Polaris	Zn, Pb	939 kt	190.7 kt Zn 39.3 kt Pb	19063.8 kt 14.3% Zn 3.8% Pb	965 kt	125 kt Zn 28 kt Pb
Pine Point	Zn, Pb	2137 kt	161 kt Zn 56 kt Pb	14515 kt 6.7% Zn 2.7% Pb	2952 kt	242 kt Zn 117 kt Pb
Cantung	WO_3	346 kt	4.7 kt WO_3	1360 kt 1.24% WO_3	137 kt	not known

* Data, from Mines Inspection Service, Government of the Northwest Territories, covers the period January, 1986 to November, 1986 inclusive.
** Figures given for Nanisivik fiscal year - April 1, 1985 to March 31, 1986.
^ Figure is an estimate provided by mine personnel.

Table 6: Production from Mines in the Northwest Territories, 1983 to 1986

Year	Gold (kg)	Silver (kg)	Zinc (kt)	Lead (kt)	Tungsten (kt)	Value ($ x 10^6)
1983	9,246	73,119	246.3	64.2	0.35	$514
1984	12,670	53,727	341.6	87.5	3.53	$800
1985	13,014	33,039	344.4	96.6	3.72	$722
1986 *	12,415	27,524	425.7	149.2	not known	~$652

* Estmates based on production figures from the Mines Inspection Service of the GNWT, for January 1986 to November 1986 inclusive.

ARCTIC ISLANDS REGION

W.A. GIBBINS,
DISTRICT GEOLOGIST

BASE METALS

In 1986, mineral activity was concentrated in the vicinity of the region's two producing Pb-Zn mines. At COMINCO LTD.'s Polaris Mine (1) on Little Cornwallis Island, work consisted of ore outline drilling. The mine was shut down for several weeks in July and early August, but is presently operating at rated capacity.

Exploration at the Nanisivik Mine (2) of NANISIVIK MINES LTD., at Strathcona Sound, Northern Baffin Island, consisted of geophysical surveys and drilling of targets in the Oceanview and K baseline areas east of the mine. Other targets were drilled west of the mine lease.

BOREALIS EXPLORATION LTD. explored zinc and nickel prospects in central Melville Peninsula. (3).

NORANDA EXPLORATION LTD. did geophysical surveys and trenching at PANARCTIC OIL LTD.'S Holy Cow copper showings in the Shaler Mountains of Victoria Island (5). The mise a la masse survey was useful in outlining the area of native copper mineralization. However, trenching showed that most of this was not in place and not economically significant.

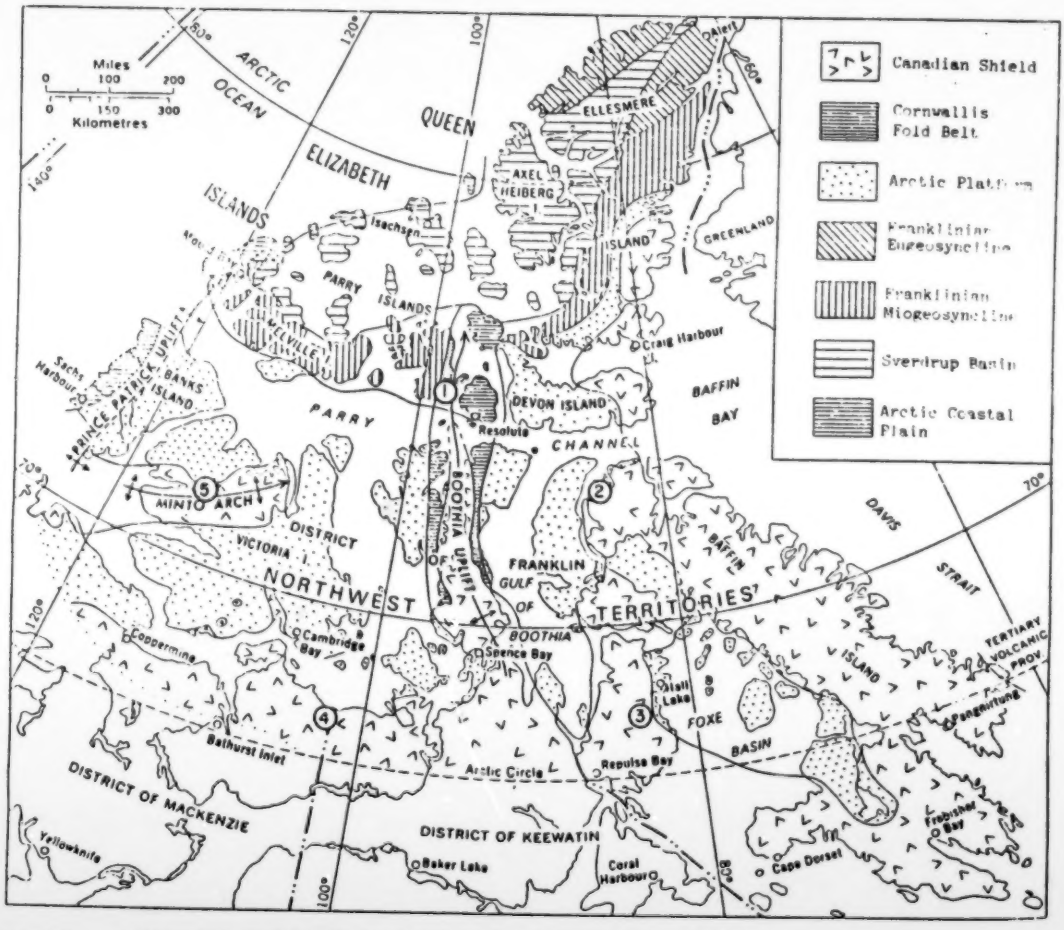

FIGURE 2: Mineral Exploration in the Arctic Islands, 1986.

KEEWATIN DISTRICT

P.J. LAPORTE
DISTRICT GEOLOGIST

GOLD

ASAMERA INC. optioned a number of properties from **COMAPLEX RESOURCES INTERNATIONAL LTD.** and established a 20-person camp on the Meadowbank River. Work on the prospecting permits and claims northwest of Tehek Lake (17) included mapping, prospecting, geochemical and geophysical surveys and diamond drilling of gold-bearing quartz-sulphide veins in felsic volcanics. Prospecting permits northwest of Whitehills Lake (11) were prospected. A 2-person prospecting crew investigated the gold potential of properties north of Macquoid Lake (9), south of Brown Lake (10), east of Judge Sissons Lake (12) and west of Laughland Lake (18).

BOREALIS EXPLORATION LIMITED invested a great deal of time and effort in establishing the extent of the gold showings discovered south of Last Lake (3) in 1985. Magnetometer, VLF and MaxMin surveys were done and 19 holes were drilled in January and February. A 20 hole drilling program on the north zone was completed in the spring. A 10-15 person crew re-occupied the camp at Caribou Horn Lake in July and proceeded to try and define ore shoots using geological mapping, lithogeochemical sampling and diamond drilling.

Borealis Exploration Limited had a second 10-person crew operating from the Henik Lake Lodge and, subsequently, the Caribou Horn Lake camp. They prospected, mapped and sampled gold showings on newly acquired permits south and west of Caribou Horn Lake (3), north of Gill Lake (4), northwest of Kaminak Lake (6) and west of Yandle Lake (7).

CANADIAN NICKEL COMPANY LTD. had a 10-person crew explore their prospecting permits on the shores of Wilson Bay (2). Reconnaissance prospecting and mapping were done, as well as detailed geophysical, geological and lithogeochemical surveys on gold showings discovered previously.

HOMESTAKE MINERAL DEVELOPMENT COMPANY entered into a joint venture with **ABERMIN CORPORATION** on properties southwest of Yathkyed Lake (8). A 16-person crew used

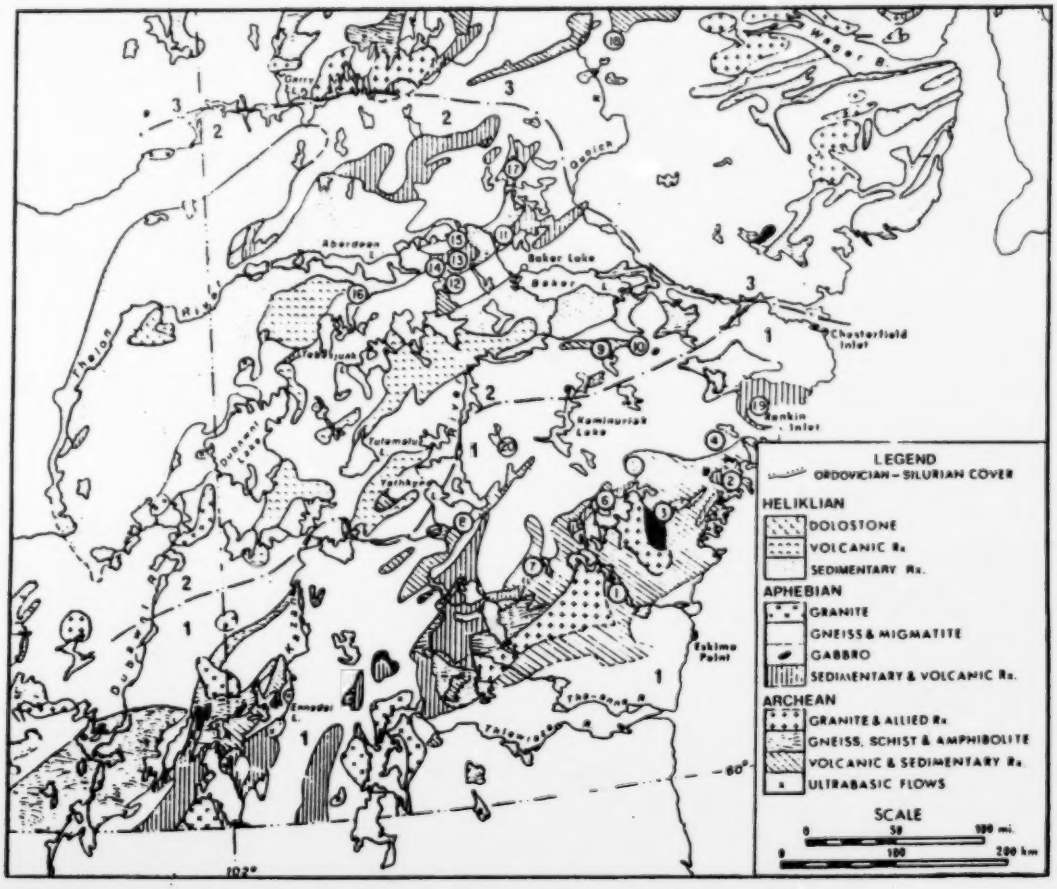

FIGURE 3: Mineral Exploration in the Keewatin District, 1986.

mapping, prospecting, geophysical surveys, lithogeochemical surveys and diamond drilling to investigate the extent of gold concentrations in sulphide-facies iron formation in Henik Group volcanics and sediments.

NOBLE PEAK RESOURCES LTD. acquired one prospecting permit north of Happotiyik Lake (5) from Borealis Exploration Limited and sent a 4-person crew to map, prospect and do magnetic and VLF surveys. A number of gossan zones on the permit were trenched by prospectors in the late 1960's.

SUNMIST ENERGY '84 INC. had a 2-person crew prospect and stake the area covered by Prospecting Permit (PP) 1025 on Maguse Lake (1). This permit and 2 LAB claims were acquired from Arctic Mining Corporation Ltd. in early 1986 and cover a previously drilled gold showing in silicified andesite.

PLATINUM

Two platinum prospects were investigated this summer. COMAPLEX RESOURCES INTERNATIONAL LTD. sampled and staked the ultramafic sill, which contained the North Rankin Nickel Mine Ltd. copper - nickel orebody at Rankin Inlet (19).

The Ferguson Lake (20) copper - nickel deposit, held under lease by INCO LTD. since the late 1950's, was also investigated. HOMESTAKE MINERAL DEVELOPMENT COMPANY sampled and staked the extensions of the amphilobite enclosing the deposit.

URANIUM

Two companies were active west of Baker Lake. PNC EXPLORATION (CANADA) LTD. had two crews in the area. One 8-person crew explored the ground optioned from BP Minerals Ltd. south of Schultz Lake (15). Prospecting, mapping and a DIGHEM survey were done to help interpret the surveys done by BP Minerals' geologists in the mid-1970's.

A second 9-person PNC Exploration (Canada) Ltd. crew explored uranium showings in brecciated gneiss north of Marjorie Lake (16). Prospecting, detailed scintillometer surveys and glacial mapping were used to determine the probable sources of the uranium-bearing boulders and a number of sections were then drilled in these areas.

URANGESELLSCHAFT CANADA LTD. had a 10 to 20-person crew at the Lone Gull camp (13) doing delineation drilling on the Main and Centre zones of their uranium deposit. Pre-feasibility geotechnical studies were also undertaken and legal surveys of the properties completed.

A second 12-person Urangesellschaft Canada Ltd. crew operated out of Pointer Lake (14) and performed ground geophysical surveys and diamond drilling on uranium showings and interesting anomalies. A DIGHEM survey was flown over the area.

EASTERN MACKENZIE DISTRICT

W.A. GIBBINS
DISTRICT GEOLOGIST

Numbers and letters refer to Figures 4 and 5 unless otherwise stated.

BASE METALS

ENEXCO INTERNATIONAL RESOURCES LTD. drilled geophysical targets, in order to test the Cu-Ni and precious metal potential of ultramafic rocks on their Rutledge Lake claims (D).

PINE POINT MINES LTD.'s 1986 exploration program was financed by $2 million of flow-through funding. Work included drilling and IP surveys (A).

BERYLLIUM AND RARE EARTH ELEMENTS

HIGHWOOD RESOURCES LTD. drilled 14 holes (+1300 m) at their Thor Lake (C) beryllium deposit in January. In July they announced an agreement had been made with HECLA MINING LTD., whereby they would proceed jointly with development of the project. Metallurgical, mineralogy and other feasibility studies continued throughout the year.

CARVINGSTONE

W.A. GIBBINS, DIAND Arctic Islands District Geologist, mapped the northern end of the Hope Bay Volcanic Belt (1), which contains considerable quantities of serpentinized peridotite with carvingstone potential, as well as numerous gossan and alteration zones.

GOLD

East of Bathurst Inlet in the area south of the Hiukitak River, the principal exploration target was gold in gossanous amphibolite in high grade schists of the Yellowknife Supergroup. ECHO BAY MINES LTD. did follow-up geophysical surveys over several claim groups from their Gambit Lake camp (8).

Most of Outpost Island (B), the site of a former Au-Cu-W producer, near the centre of Great Slave Lake, was staked by G. SAGE in April, 1986.

SILVER HART MINES LTD. did geological and geophysical surveys and some drilling of a target at Katherine Lake (7). Additional claims were staked in the area by LLOYD ANDERSON and ENEXCO INTERNATIONAL LTD. (6). Some trenching and sampling were done at these claims.

PLATINUM

The PLATINUM 1 claim, staked near the mouth of the Perry River (4 on Fig. 2), covers a previously discovered Ni-Cu prospect.

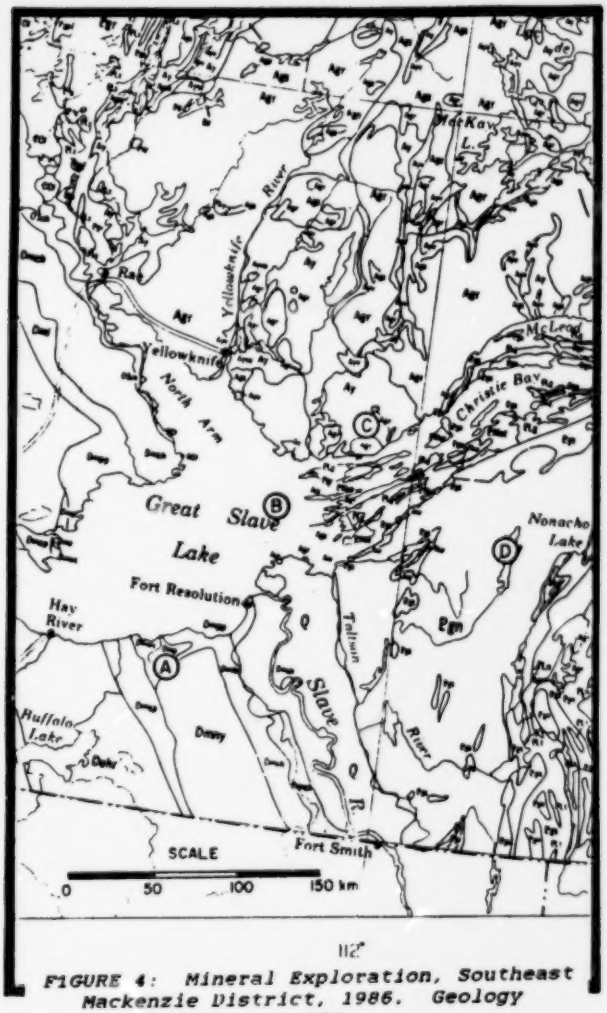

FIGURE 4: Mineral Exploration, Southeast Mackenzie District, 1986. Geology from GSC Map 30-1963.

NORTHERN SLAVE PROVINCE

J.B. SEATON, DISTRICT GEOLOGIST
J.C. CRUX, GEOLOGIST

GOLD

Almost all exploration in the northern Slave Province was for gold, and with few exceptions, the target of the exploration programs reported was auriferous "iron formation"; a term which is probably frequently misused and loosely applied to a wide spectrum of ferruginous and commonly amphibolitic metasediments.

AURUN MINES LTD. conducted geophysical surveys on their COM 1, 2 claims (21), southwest of Contwoyto Lake. The claims are devoid of outcrop. The surveys outlined strong VLF-EM conductors along 2.5 km with coincident moderate SP and weak magnetic anomalies.

BACK RIVER JOINT VENTURE, for whom Trigg, Woollett, Olsen Consulting Ltd. is operator, maintained a large base camp at George Lake from which they explored their extensive property in the Beechey Lake and Back River areas. Much of their work was on the large block of prospecting permits and claims in the Beechey Lake area (16). Work included ground follow-up to a DIGHEM airborne survey, grid construction, geological mapping and prospecting, EM and magnetic surveys and diamond drilling.

BOW VALLEY INDUSTRIES LTD. explored for gold on several of their claims in the Contwoyto Lake area (21, 23). On the AMPH 1, 2 claims, 68.6 line km of ground geophysical (HLEM, VLF, magnetometer and gradiometer) surveys were done. Five holes were drilled, totalling 532 m. Gold, assaying up to 2.33 g/t over 0.90 m, was intersected. On the AU 2,3 claims, one hole totalling 80.0 m was drilled. Another hole, totalling 101.0 m, was drilled on AU 17. BARB 1 was explored with several geophysical surveys (magnetometer, VLF and gradiometer). Three holes, totalling 276.4 m were drilled. Gold assayed up to 5.49 g/t over 0.38 m. Drilling was also done on AU 5 (1 hole, 101.0 m) and KAP 1 (1 hole, 65.0 m). Seventy-eight line kilometres of grid were laid out over the MINER claim and geological mapping and HLEM, VLF and magnetic surveys done. Reconnaissance HLEM and magnetic surveys (about 3.8 line km) were carried out over the NEMO claim. Eleven and a half line kilometres on the OP 1 and AU 16 claims were explored using HLEM, VLF and magnetic surveys. Four diamond drill holes, totalling 418.35 m were drilled. Gold was intersected at several locations and ranged from 1.10 g/t Au over 0.50 m to 4.01 g/t over 0.28 m. The PIXIE claim was also drilled (10 holes, 939.9 m) and geophysically surveyed (31 line km; HLEM, VLF, gradiometer, magnetometer). Part of the claim was geologically mapped.

BRINCO LTD. explored the WEST claim (23), west of Lupin Mine, by constructing 32 km of grid, geological mapping, magnetic surveying, rock chip sampling and diamond drilling 9 holes.

CANUC RESOURCES INC. resumed exploration of the "Arcadia" property (11) late in the summer. The main thrust of their program was additional drilling to the Fred Vein (northeast of the North Vein), where 14 holes were drilled. Geological mapping, soil sampling and VLF-EM surveying were performed on a grid covering the projected northeastern extension of the North Vein.

COMINCO LTD. explored the CTL, DIGGER and other claims (21) on the west side of Contwoyto Lake by EM and magnetic surveying and by geological mapping. Twelve targets selected by this work were drilled.

South of the Hood River (14), Cominco constructed a grid on the VER 1-4, SGJV 1 claims and Prospecting Permit (PP) 1031. The grid was explored by geological mapping, EM and magnetic surveying and rock sampling.

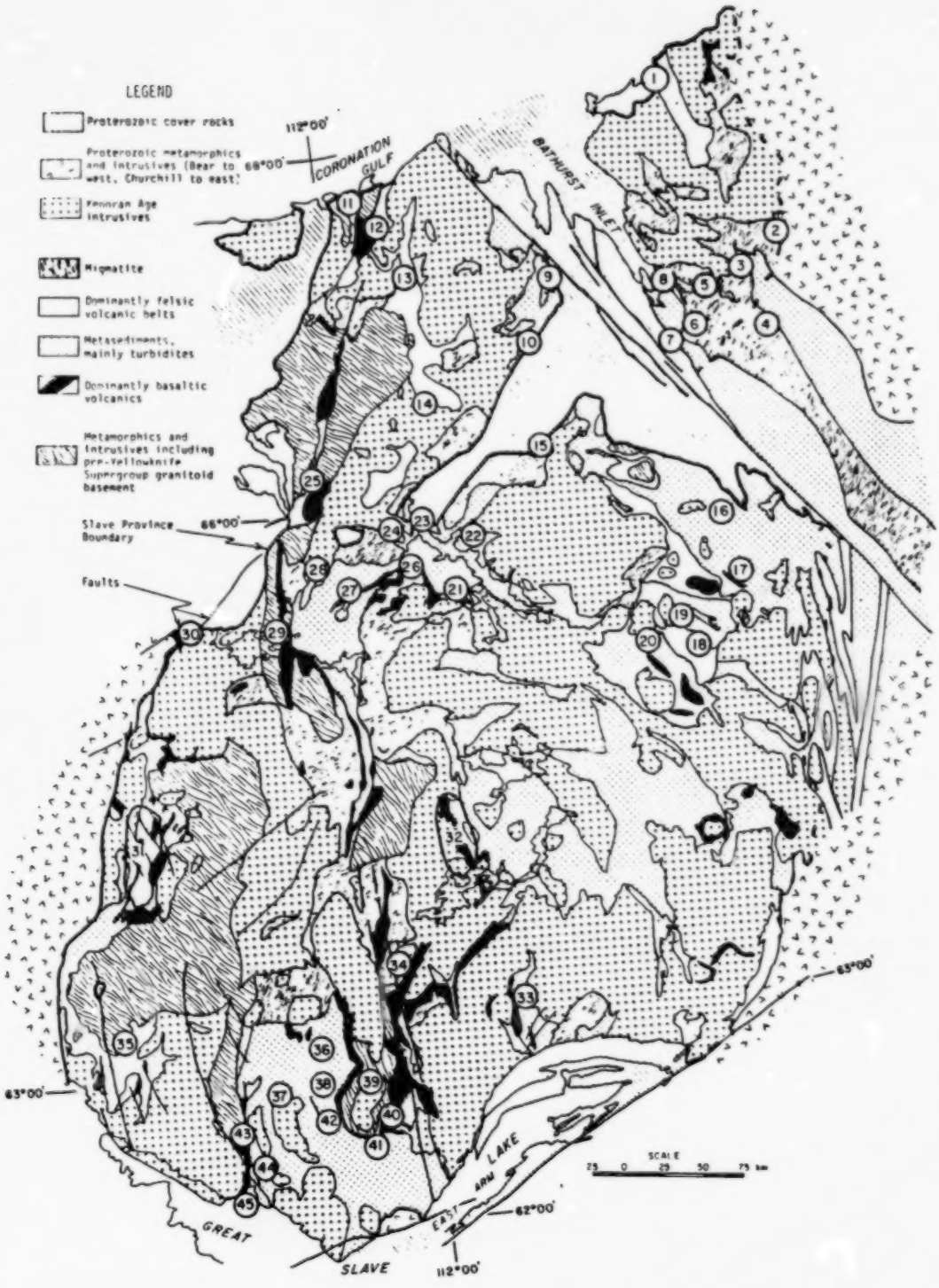

FIGURE 5: Mineral Exploration, 1986, Slave Structural Province.

ECHO BAY MINES LTD.'s exploration in the northern Slave Province was much reduced relative to 1985. In 1986 the field crew consisted of 4 or 5 persons only.

East of Bathurst Inlet, Echo Bay explored the HUNT 1, 12 (8); EGG (3); and BEAR (5) claims by magnetic surveys and additional prospecting. On the JAN claim, trenches excavated in 1985 were sampled and a grid geologically mapped. The SHEL (2) and WING (4) claims were prospected.

South of the James River, in a northeasterly trending metasedimentary belt which locally contains iron formation and which elsewhere is mainly staked by Silver Hart Mines, Echo Bay Mines prospected, geologically mapped and geophysically prospected the DOUGALL 1-4 claims (between 9 and 10).

In the Contwoyto Lake - Itchen Lake metasedimentary belt (24, 28), Echo Bay Mines explored the CAR claims southeast of Rockinghorse Lake and the RUSH and CUB claims (28), and PP 1074 at the northern end of Itchen Lake. This work was a follow-up to a DIGHEM airborne survey and comprised mapping, prospecting and magnetic surveying. Thirty-four anomalies were evaluated using one or more of the above techniques.

GIANT YELLOWKNIFE MINES LIMITED explored for gold on the ALGOOD claims (19) in the Regan Lake area and on the TREE and TESS claims (29) in the Tree Lake area. Work included detailed geological mapping in conjuction with ground magnetic, VLF, HLEM and MaxMin surveying.

HECLA MINING COMPANY OF CANADA LTD. explored the JOHN, SHIN and DLER claims (22) east of Contwoyto Lake. Grids were constructed over numerous geophysical anomalies found by a 1985 DIGHEM airborne survey. The anomalies were investigated on the ground by geological mapping, EM and magnetic surveying and by sampling.

SILVER HART MINES LTD. flew DIGHEM surveys over most or all of their claim holdings, which extend some 60 km northeasterly from west of the confluence of the Booth and Hood rivers (10) to near the confluence of the Hood and James rivers (9). A DIGHEM survey was also flown over the G & T, FOX, and CHAR claims (6), on the east side of Bathurst Inlet. Geological mapping was done over most of the Silver Hart properties. Trenching was used to explore prospects in the "Turner Lake" and "Pistol Lake" areas (9) north and south respectively of Wilberforce Falls. Diamond drilling tested iron formation on the G & T claims (6).

Large blocks of claims were staked directly southeast of the Booth River (10) and south of the junction of the Burnside and Mara rivers (15).

UTAH MINES LTD. employed a small crew to geologically reconnoitre and prospect most volcanic belts in the Slave Structural Province. In the northern Slave Province, one or more reconnaissance traverses were made in the Point Lake, Takijuq Lake (25), Redrock Lake (30), Central ("Olga Lake") Volcanic Belt (26, 27), High Lake(13), and Anialik River (12) areas. As a result of this work, five groups of claims were staked.

WELCOME NORTH MINES LTD., as operator in a joint venture with BOW VALLEY INDUSTRIES LTD., explored claim blocks in the Beechey Lake area (17) and in the Thistle Lake area (20); marginal to and within the Back River Volcanic Complex.

In the Beechey Lake area (17), Welcome North explored the Beechey Property, comprising the BOW 2,4; JB 2; BEEP 1-8; and DEL 1-5 claims from their camp at "Diving Elephant Lake" in the centre of the claim block. Work comprised geological mapping, prospecting and extensive trenching and chip sampling. Eleven holes were drilled on the two most promising gold showings of the Beechey Property. Drilling did not intersect encouraging gold values, such as were found in surface and trench samples. The auriferous zones lie southwest of Diving Elephant Lake on the BOW and JB 2 claims, and are stratabound within a northwesterly trending, steeply southwest-dipping unit of crenulated argillaceous greywacke. This unit is 100 to 400 m wide and is enclosed by less argillaceous greywacke of the Beechey Lake Group. The silicified auriferous zones have widths of up to 10 m and may be as much as 120 m long. They are characterized by concordant and discordant quartz veins, pervasive silicification and 1% to 4% euhedral arsenopyrite.

Welcome North Mines Ltd. explored the Thistle property (20) by geological mapping, prospecting and extensive trenching. The Thistle property extends along the western margin of the Back River Volcanic Complex for roughly 30 km. A gold zone in the northern third of this belt of claims on the BOW claim was explored by several trenches. Although one trench yielded a sample with as much as 16 g/t Au across 2 m, other trench samples gave much lower assays and drilling was not done.

The remaining ground held by the Welcome North Mines - Bow Valley Industries Joint Venture, RING 1-3 in the central part of the Back River Volcanic Complex (18) and RING 4 near its eastern margin (18) was prospected.

OTHER METALS

Silver Hart Mines reported the discovery of a large body of disseminated to semi-massive nickel, cobalt and copper minerals in an olivine gabbro plug in the "Turner Lake" area (9). Samples from this prospect were assayed for nickel, cobalt, copper, gold, platinum and palladium.

SOUTHERN SLAVE PROVINCE

J.A. BROPHY
DISTRICT GEOLOGIST

GOLD

ABER RESOURCES LIMITED and HIGHWOOD RESOURCES LIMITED reported encouraging drill results on the BUGOW gold property in the Russell Lake area (35). All four holes drilled prior to Aug. 7, 1986, intersected ore-grade sulphide-rich amphibolite across widths ranging from 1.51 m to 8.78 m. The best intersection was 8.0 m grading 15.64 ppm Au. Results from additional drilling in August are not available. Further drilling is planned after freeze-up. Work was also done on the Jax Lake property and EUD claims in the Courageous Lake area (32), on the AP claims in the Cameron River area (38), and on the FUR and DY claims in the Indin Lake area (31).

ARDIC EXPLORATION LTD. fielded three men for five weeks to conduct detailed mapping of priority targets on the Thompson-Lundmark Mine property (42). About 5800 m of core from earlier drilling were sent to Toronto for re-logging.

ARGUS RESOURCES LIMITED fielded a 10-person crew to conduct reconnaissance exploration involving prospecting, rock geochemical surveying and staking. The principle target was gold in the southern Slave.

COMAPLEX RESOURCES INTERNATIONAL LTD. and PETROMET RESOURCES LTD. did geological mapping and sampling surveys on the SPAN claims in the Indin Lake Volcanic Belt (31). Two auriferous zones comprising quartz, arsenopyrite, and pyrrhotite in mafic volcanic rocks were identified. Thirteen chip, channel and grab samples from the larger zone (South Zone) returned an average assay of 12.7 ppm Au; the highest assay was 78.5 ppm Au across 1.5 m. The South Zone is 150 m long, open at both ends, and up to 9.0 m wide.

COMINCO LTD. drilled four holes totalling 248 m and completed 8.5 line km of ground magnetic surveying on the BUGOW claims in the Russell Lake area (35), where auriferous amphibolite units have been identified. Additional drilling in 1986 was done by ABER RESOURCES LTD. after Cominco relinquished its option on the property. In the Courageous Lake-Mackay Lake Volcanic Belt (32), Cominco drilled four holes totalling 676 m on the MOG claims and three holes totalling 562 m on the BLAKE claims to test anomalies obtained from an earlier IP survey. The BLAKE and MOG claims cover the northern extension of the felsic volcanic succession hosting the Tundra deposit, which is being developed by a Noranda Mines/Getty Resources Ltd. joint venture.

DELAWARE RESOURCES LIMITED conducted prospecting, VLF-EM and lithogeochemical surveys on properties held in the Indin Lake area (31).

ECHO BAY MINES LTD. drilled about 2000 m on the Main Zone and 3000 m in 27 holes on the newly discovered Cass Zone on the KIM claims in the Indin Lake Volcanic Belt (31). Echo Bay is the operator of this property, which is held in joint venture with COMAPLEX RESOURCES INTERNATIONAL LTD. and PETROMET RESOURCES LTD. Additional drilling is anticipated during the winter of 1986/87 on the Cass Zone, which is described as an auriferous quartz stockwork carrying pyrrhotite, arsenopyrite and pyrite in a sill-like gabbroic host. Preliminary results indicate that the Cass Zone has a strike length of at least 300 m, a minimum depth of 70 m, and a true width ranging from about 1-15 m (average 4.8 m). The higher-grade gold concentrations appear to be confined to a series of en echelon subparallel shoots that plunge steeply southeast. Twenty-one of the 27 holes drilled on the Cass Zone at 20 m spacings have encountered visible gold. Assay results on core are not available. Drilling on the Main Zone confirmed its extension to a vertical depth of 360 m with grades averaging 7.2 ppm Au across an average width of 4.5 m. Additional work on the KIM claims included geological mapping, geophysical surveying and trenching. To the north of the KIM property, on the BAN claim optioned from Mr. J. Raines, Echo Bay completed 1:2500 scale geological mapping and a soil sampling survey.

GIANT BAY RESOURCES LTD. conducted a program of underground development and bulk sampling on the Kidney Pond Zone in the Knight Bay area, Gordon Lake (38). A decline was advanced 450 m to the 60 m level. Work included 150 m of drifting in ore, 165 m of raising, 1800 m of underground drilling, 760 m of surface drilling and the collection of bulk samples. Assay results from the bulk samples were mostly less than 3.5 ppm Au. Additional drilling (900 m) was done on the Lynk Zone to the northeast of the Kidney Pond Zone.

GIANT YELLOWKNIFE MINES LIMITED explored a number of properties for gold in 1986. Trenching, mapping and ground magnetic and VLF-EM surveying were done on the KA claims in the Bridge Lake area (34). On the TORO claims in the Sophia Lake area (37), the GIVER claims in the Amacher Lake area (40), the COKE claims in the Fenton Lake area (39), and the SHEET claims in the Sunset Lake area (40), work included prospecting, lithogeochemical surveying, trenching and ground geophysical surveying. Airborne geophysical surveys were flown over the GYM and BRI claims in the Indian Mountain Lake area (33), which are held in joint venture with ASAMERA INCORPORATED and KELMET RESOURCES LTD. Ground work on these joint-venture properties included mapping, trenching and lithogeochemical and soil sampling.

GOLDEN MARLIN MINES LTD. continued marine seismic surveying of their extensive MARLIN claim block in Yellowknife Bay (45).

Roughly 500 line km of seismic surveying were done in 1986, bringing the cumulative total for 1984-86 to about 4000 line km. Shear zones interpreted by the seismic survey were checked for sulphide concentrations using IP through ice or a boat-towed array. A winter drilling program (21 holes, about 2100 m) was conducted on Yellowknife Bay to probe for southern extensions of the Campbell Shear Zone on the MARLIN claims. Inferred shear zones from the marine seismic surveys were confirmed and low grade gold intersections were reported.

GOLDEN RULE RESOURCES LIMITED conducted airborne magnetic and EM surveys on the CASS 7 and DAVE claims in the Indin Lake area (31). Additional work on CASS 7 included geological mapping and lithogeochemical sampling. Two samples of sheared volcanic rock contained anomalous gold (2.0 to 2.4 ppm).

WALTER HUMPHRIES and JIM KELLY spent 90 person-days mapping and sampling the WAL, TING and EQUINOX claims in the Walsh Lake area north of Yellowknife (43), where gold-bearing zones in a variety of settings have been identified.

NORANDA EXPLORATION COMPANY LTD. worked on various properties in the southern Slave. In the Russell-Slemon lakes area (35), about 500 line km of airborne DIGHEM VLF-EM and magnetic surveying were completed on 25,000 ha of property staked to cover terrain favourable for amphibolite-hosted gold deposits. Additional work included 1:20,000 scale geological mapping, prospecting, and minor soil geochemical sampling and trenching. In the Clan Lake area (43), airborne DIGHEM VLF-EM and magnetic surveying was completed on the BOSS claims. Ground work included 1:10,000 scale geological mapping, prospecting, soil sampling (about 1000 samples) and minor trenching. In the Weaver Lake area (41), detailed geological mapping was conducted over parts of claims staked principally for their volcanogenic massive sulphide potential. Elsewhere in the Slave, Noranda conducted reconnaissance exploration for gold. On the Tundra property, held jointly by Noranda and GETTY RESOURCES LTD. in the Courageous Lake-Mackay Lake Volcanic Belt (32), a 3000 m drilling program is planned for the winter of 1986/87 on the Fat Gold Zone. A recent prospectus announced that 8000 m of drilling in 41 holes completed on the Fat Gold Zone to the end of 1985 has outlined probable reserves of 1.16 Mt of ore grading 9.60 ppm Au, along a strike length of 1200 m and to a vertical depth of 120 m. Three deep holes established dip continuity beyond 440 m, with one hole intersecting a true width of 6.1 m grading 19.2 ppm Au at a depth of 364 m.

ROBINSON INVESTMENTS LTD. and GENESIS RESOURCES CORPORATION conducted rock geochemical, EM and magnetic surveys on the JOON lease and contiguous claims in the Bullmoose Lake area (42), about 55 km east-northeast of Yellowknife, to evaluate gold-bearing quartz veins in turbidites.

SUNCOR INCORPORATED completed a program of geological mapping, trenching, chip sampling and prospecting on property optioned from TREASURE ISLAND RESOURCES LIMITED in the Spider Lake area, north of Indin Lake (31). Gold showings were identified in metavolcanics, metasediments and felsic dykes. Sampling has indicated grades ranging from 3.4 to 37.0 ppm Au across widths of 0.7 to 2.0 m in eight separate showings.

TERRA MINES LIMITED's Bullmoose test mill at Bullmoose Lake (42), an auriferous quartz vein deposit in turbidites, is currently operating at an average daily rate of 170 t. The mill was carried to the mine site by truck on winter roads and was operational by April, 1986. Although some start-up problems were encountered, these were resolved by July, when 47 kg of gold were produced from 3.6 kt of ore with an average head grade of 14.39 ppm Au. If this milling rate and grade is sustained for the remainder of 1986, Terra will produce about 300 kg of gold (worth about $6 million) from about 20 kt of ore this year. Terra has no plans to install a cyanide circuit in the mill because of environmental considerations. At present, 60% of the gold is being recovered with jigs and the remainder is shipped out as a flotation concentrate for further refining at Cominco Limited's smelter in Trail, B.C. Most ore is being drawn from the No. 4 Zone, which includes about 40 different veins. The decline into the No. 4 Zone has been established to the 212 m level, and although ore grade intersections have been encountered in drilling to a vertical depth of 606 m, there are presently no plans to extend the decline deeper. Future development will focus on driving a decline into the No. 7 Zone, which carries about 200 kg of gold. As of April 30, 1986, proven and probable reserves at Bullmoose total 49.5 kt grading 14.15 ppm Au and possible reserves total 90 kt grading 16.45 ppm Au.

Elsewhere in the Slave, Terra conducted mapping, trenching and sampling surveys on the WOLF claims in the Spencer Lake area (36) and on the TT claims in the Dome Lake area (38).

TREMINCO RESOURCES LTD. did underground development work, geological research, detailed sampling and test milling on the Tom deposit north of Yellowknife (43). About 9000 t of ore grading 6.8 ppm Au were test milled at nearby Giant Mine. About 53 kg of gold were produced at a recovery rate of about 85%. Treminco also acquired an option from Cominco on Ptarmigan Mine near the Tom prospect, and controlling interest in the WT (NTS to I/14) and GAB (NTS 85 P/4) claims west of Gordon Lake. Geological mapping and sampling was done on the WT and GAB claims.

On behalf of TROYMIN RESOURCES LTD., Taiga Consulting Ltd drilled 11 shallow holes totalling 500 m to test gold-bearing zones in sediments and intercalated volcanics on the MON property, a Cominco lease in the Discovery Lake area north of Yellowknife (45).

UTAH MINES LTD. fielded a crew of 6-8 persons to evaluate the RAND claims east of Yellowknife (44). Work included geological mapping, ground geophysical surveying, rock-chip sampling and minor linecutting.

BEAR PROVINCE

J.B. SEATON
DISTRICT GEOLOGIST

PLATINUM GROUP METALS

Increased platinum prices stimulated exploration for platinum group metals in 1986. As a result, the layered mafic-ultramafic Muskox Intrusion, previously explored mainly for its nickel and copper potential, was largely staked by EQUINOX RESOURCES LTD. and by INTERNATIONAL PLATINUM CORPORATION (previously Silver Lake Resources Ltd.).

EQUINOX RESOURCES LTD. set up camp at Speers Lake (3) near where much of their exploration, which included geological mapping, rock and silt sampling, was concentrated. Equinox drilled targets on the SPEE claims, north (5 holes) and south (2 holes) of Speers Lake. In the fall, they explored their VAL claims, south of McGreggor Lake, by magnetic and EM surveys. Equinox's exploration was in joint venture with TECHNIGEN PLATINUM CORPORATION.

INTERNATIONAL PLATINUM CORPORATION, (Silver Lake Resources Inc., prior to Aug 26, 1986), operating out of the old Inco camp at McGreggor Lake (3), explored their property by geological mapping and lithogeochemical surveys. International Platinum Corporation holds two groups of OX claims: one at McGreggor Lake and extending north to Speers Lake; and the other, north of Speers Lake.

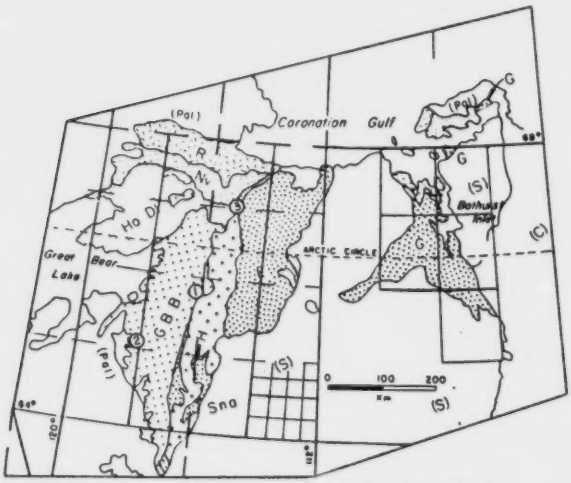

FIGURE 6: Mineral Exploration 1986, Bear Province.

URANIUM

After briefly resuming exploration of Prospecting Permit (PP) 1030 (1), near Dumas Lake in the spring, CEGB EXPLORATION (CANADA) LTD. moved camp to Longtom Lake (2)from where they explored PP 1098 and 1099. Work included geological mapping and prospecting. Soil geochemistry and geophysics were performed on two grids and a uranium prospect was delineated and trenched.

CORDILLERA DISTRICT

J.A. BROPHY,
DISTRICT GEOLOGIST

Few exploration projects were conducted in 1986, reflecting the depressed market conditions of the main commodities (W, Pb, Zn, Cu) that have been sought in the NWT Cordillera. At the beginning of 1986, there were 2014 claims in good standing in the Cordilleran District. To date (Oct/86), no new claims have been staked amd 43 claims were allowed to lapse. This compares to three claims staked and 392 claims lapsed in 1985. CANADA TUNGSTEN's Cantung Mine, the biggest tungsten producer in the Western Hemisphere, was officially closed on Aug. 12, 1986, as a consequence of low tungsten prices, which fell to $43-$45/STU from a high of $130/STU several years ago. Canada Tungsten's Mactung Deposit, which has been under development for several years, was placed on caretaker status. No surface exploration was done at either Cantung or Mactung in 1986.

BASEMETALS

PROCAN EXPLORATION COMPANY LIMITED conducted a soil geochemical sampling program on the Prairie Creek property (1) to evaluate a Ag-Pb-Zn showing about 6 km north-northeast of the mine site.

GOLD

GIANT YELLOWKNIFE MINES LIMITED prospected, trenched and drilled (4 holes, 242 m) for gold on the GRUMP claim (3).

SEREM INCORPORATED prospected and mapped the CHUCK claim (2), where previous surveys had identified a coincident gold-arsenic geochemical anomaly.

TUNGSTEN

HUDSON BAY EXPLORATION AND DEVELOPMENT CO. LIMITED conducted a one week program of soil geochemical and heavy mineral sampling to explore for tungsten on the QUICK and EASY claims (4).

1986 FIELD ACTIVITIES OF THE CORDILLERAN DISTRICT GEOLOGIST

During the month of August, I joined Dr. C.W. Jefferson's GSC field crew, who were

based in the Tungsten area, to evaluate the mineral potential of a proposed extension to Nahanni National Park. This being my first season as the NWT Cordilleran District Geologist, I was particularly interested in familiarizing myself with the geology and mineral deposits of the Tungsten area, where I have had little previous work experience. I was fortunate in being able to draw on the expertise of Dr. Jefferson and Dr. Ken Dawson, who was with us during the first part of the month. I accompanied them on their excursions to evaluate a variety of mineral prospects in the region, including tungsten-skarn, stratabound lead-zinc, and pegmatite-hosted lithium deposits. I also participated in the evaluation of the proposed park extension area by collecting stream sediment samples and prospecting areas of interest.

Prior to the field season, I reviewed assessment reports relevant to the proposed park extension and environs with a view towards identifying targets for gold exploration. One assessment report briefly mentioned placer gold at the headwaters of Bennett Creek (NTS 95 E/7, 61°17'N, 126°40'W). I prospected this area and collected twelve stream sediment samples, which will be analyzed for gold and other elements (analyses will be included as part of the GSC release of survey results in the proposed park extension area). The Bennett Creek area is underlain by granitic intrusions of Cretaceous age and sediments of the Paleozoic Road River Formation. The creek valley is heavily forested and no outcrops were observed. Float was mainly of granitic material containing feldspar phenocrysts. A fist-sized sample of quartz collected from float contained 0.21 ppm Ag and less than 2 ppb Au.

Another area of interest for gold is at the headwaters of Flat Creek (NTS 105 I/1, 62°02'N, 128°10'W). This area is mainly

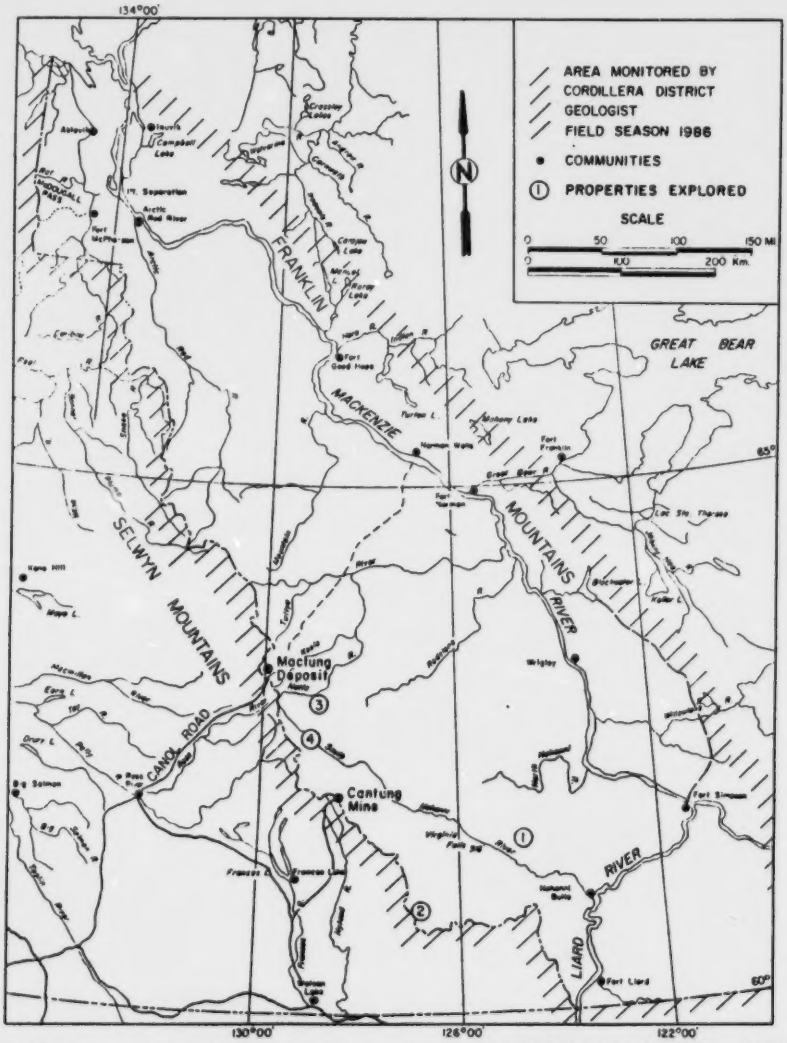

FIGURE 7: Mineral Exploration in the Cordilleran Region, 1986.

underlain by Cambrian and earlier turbiditic sediments. A considerable amount of galena and arsenopyrite-bearing quartz float was found scattered across about one kilometre of the east-west scree slope on the north side of the creek. Unfortunately, hail and snow ended the prospecting day before the float could be traced to source. However, the following geochemical results are available from float:

Sample No.	ppb Gold	ppm Silver
C 86-4	356	8*
C 86-5	280	8
C 86-6	598	8
C 86-7	88	8
C 86-8	172	1.03

*8 ppm Ag is the maximum reliable detection limit of the geochemical analyses.

STRATIGRAPHY AND STRUCTURE OF TENT OUTLIER, NONACHO BASIN, DISTRICT OF MACKENZIE, NWT

LAWRENCE B. ASPLER
CARLETON UNIVERSITY

Mapping at a scale of 1:50,000 has confirmed that lower greenschist facies sedimentary rocks exposed in two belts between Tent and Whitefish Lakes, although highly strained, are part of the Nonacho Group. Lithostratigraphic correlation of units in the outlier is based on lithologic criteria, position of individual units in a sequence and comparison with those areas in the main basin in which low-strain protolith can be traced into high-strain equivalents. Basement lithologies include amphibolite facies, isoclinally folded para-(?) gneisses and a variety of pre- and post-isoclinally folded granitoid rocks. Typical of the high-strain western margin of the basin, the basement/Nonacho unconformity is obscured by faults. Conglomeratic rocks are assigned to the basal breccia/conglomerate member of the Hjalmar Formation, and consist of angular to subrounded clasts of basement derivation set in an arkose matrix. Arkoses with local single pebble layers, heavy mineral bands and centimetre to decimetre-scale pelitic layers represent the monomictic pebbly sandstone member of the Tronka Chua Formation. The Chief Nataway Formation consists of centimetre to decimetre-scale mudstone/sandstone rhythmites. By analogy to better preserved equivalents in the main basin, this fining-upward megasequence is inferred to represent a talus slope / alluvial fan / braided stream / lacustrine depositional system developed during fault-induced basin initiation followed by backwasting of source areas.

Structural trends in basement are generally concordant with contacts with the Nonacho Group, and strike northeast, with near-vertical dips. Narrow mylonite zones display gently plunging stretching lineations, confirmed by plots of poles to intersections of bulk layering and oblique fabrics. Reliable kinematic indicators (C/S fabrics, shear bands, Type 1 and Type 2 asymmetrical pull-aparts) are sparse but consistent, tentatively suggesting sinistral strike-slip. In the Catholic Lake area, zones of mylonitic basement (both gneisses and granitoids) are not considered rhyolites, as has been previously reported. Overprinting by D3 in the Tent outlier is sufficiently pervasive so as to destroy any evidence of the earlier structural history preserved in Nonacho strata of the main basin. Primary layering is transposed; all units display a strong S3 fabric. Near-vertical northeasterly-sriking basement-cover faults are, tentatively, considered to have been sites of sinistral strike-slip. As with the basement, kinematic indicators within the sediments are sparse but consistent, and include C/S fabrics, Type 2 asymmetrical pull-aparts, shear bands, displayed broken clasts in conglomerates and Foliation Fish. D4 structures include local open folds which crumple previously near-vertical layers about near-horizontal axial surfaces. The main manifestation of D5 is a conjugate set of brittle strike-slip faults (north-northwest trending sinistral, northeast-trending dextral). The two belts of Nonacho strata in the outlier are not considered to be the limbs of a single fold, as has previously been suggested, but as discrete slivers, dismembered and rotated by a vertical component of the predominantly strike-slip displacement vector.

Samples of paleoplacers in sandstones from the outlier form part of a suite for ongoing heavy mineral and detrital zircon geochronologic studies of the entire basin.

YELLOWKNIFE GRANITES PROGRESS REPORT

DAVID J. ATKINSON
UNIVERSITY OF WESTERN ONTARIO

Geological field mapping of the granites was carried out during the summer of 1986 from June 1 to August 26. Geology maps by J.B. Henderson (1:250,000) and A.W. Jolliffe (1:63,360) helped to coordinate the summer mapping program. The granites are accessible by road east and west of Yellowknife; by beaver aircraft and boat to the north and south. Centres of work included the Yellowknife townsite, the West Mirage Islands, Duckfish Lake and Awry Lake. Traverses were plotted on orthophotographic territorial resource base map sheets (1:30,000) and airphotos (1:12,000). All major features of the granites were photographed. Time spent on the individual plutonic suites may be represented as:

Defeat>Awry=Stagg>Anton=Duck>Prosperous.

Professor Fyfe visited the area for two days (August 9 and 10), lending new ideas on the granites traversed, including the Western Granodiorite (WGD), Southeastern Granodiorite (SEG), the Stagg and Awry Plutonic Suites and the Prosperous Lake Granite.

Approximately 300 samples were collected from the Defeat (SEG and WGD), Anton, Awry, Duckfish and Stagg Plutonic Suites. Two hundred new thin sections have been produced as detailed petrography of the granites continues. Twenty polished slabs highlight major textures and structures of the plutonic suites.

Fifty representative samples from the collection were prepared and sent to XRAY

Labs in Toronto for whole rock analyses. Powdered pellets, prepared from the same sample set, are being analysed by XRD for trace elements at the University of Western Ontario. Standard plots of the whole rock versus trace element data will aid in selecting a sub-sample series (approximately 30 samples) for oxygen isotope analyses. Mineral separates (quartz, feldspar, mafics) of the 50 samples have been prepared for the oxygen analyses.

The sub-sample set will also be analysed for strontium isotopes. The results will be plotted against the oxygen isotope data to determine crustal sources for the heterogeneous granites and their enclaves. Crustal sources and magma-tectonic regimes of the granites have obvious implications to the recent hypothesis on Archean seafloor spreading in the Yellowknife Greenstone Belt outlined by Helmstaedt, Padgham and Brophy (1986).

Several samples, collected from the hydrothermally altered parts of the WGD, Stagg, Duck and Awry complexes, are being tested with oxygen isotope analyses to determine the source fluids and temperatures of the respective hydrothermal regimes.

REFERENCES:

Helmstaedt, H., Padgham, W.A., and Brophy, J.A., 1986:
Multiple dykes in lower Kam Group, Yellowknife Greenstone Belt - evidence for Archean sea floor spreading; Geology, July 1986.

STRUCTURAL SETTING, AGE AND WALLROCK GOLD GEOCHEMISTRY OF AURIFEROUS QUARTZ VEINS IN TURBIDITES OF THE YELLOWKNIFE SUPRACRUSTAL BASIN

JOHN A. BROPHY, DISTRICT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM

About 3.75 t of the NWT's total gold output of 375 t has come from turbidite-hosted quartz vein deposits in the Yellowknife Supracrustal Basin. The basin sediments have been affected by three deformations: D1, which formed mainly isoclinal F1 folds with no associated axial-planar fabric; D2, which is only locally developed and is associated with S2 segregation cleavage; and D3, which formed small amplitude F3 folds and is associated with S3 cleavage that is the most pervasive in the basin. Most of the auriferous quartz veins are either in stratiform zones folded by D1 or in the hinge zones of F1 folds. Association with early structures suggests that gold mineralization took place early in the deformational history of the basin, ranging probably from pre- to post-D1. This is supported by fabrics observed in thin sections of arsenopyrite-rich argillites collected adjacent to several auriferous quartz veins. Association of gold and arsenopyrite (up to 17.6 ppm gold in arsenopyrite-rich argillite) suggests that these minerals are contemporaneous. Pressure shadows formed by S3 around arsenopyrite porphyroblasts confirms that the arsenopyrite, and therefore probably the gold, is pre-D3.

Field work has established a strong lithological association between gold-bearing quartz veins and the more argillaceous units. Over 100 argillite samples were collected and analyzed for gold. Argillites collected from areas where no gold-bearing quartz veins have been recorded contain less than 5 ppb Au at the 80 percentile level. Samples from the vicinity of gold-bearing quartz veins contain 13 ppb Au at the 80 percentile level, suggesting that gold can be used as a pathfinder in a lithogeochemical survey. Argillites collected immediately adjacent to auriferous quartz veins contain 200 ppb Au at the 80 percentile level, suggesting that either they were the source of gold in the vein or they were enriched by seepage from the vein.

GEOLOGY OF THE LUPIN GOLD DEPOSIT AN UPDATE

H.R. BULLIS, CHIEF GEOLOGIST
D.M. STRACHAN, SENIOR MINE GEOLOGIST
LUPIN OPERATIONS

INTRODUCTION

LOCATION

The Lupin Mine is on the northwest shore of Contwoyto Lake, about 400 km northeast of Yellowknife, NWT. This location places the mine about 80 km south of the Arctic Circle and about 1,400 km north of Edmonton, Alberta.

The mine is within the tundra regions where topographic relief is low and vegetation is sparse, consisting mainly of moss and lichen. The area is north of the tree line and small bushes rarely can be found. The climate is subarctic. This year, ice breakup on Contwoyto Lake occurred during the first week of August and freeze-up had started by mid-September.

HISTORY

First located in 1960 by Canadian Nickel Company exploration crews, the Lupin deposit was subsequently examined by that company from 1962-64. By the end of 1964, Canico had completed 11,870 m of diamond drilling, 585 m of trenching, 195 m of overburden stripping, 368 m of channel sampling and 95 km of geological mapping and geophysical surveys.

Little work was done on the claims from 1964 to February, 1979, at which time Echo Bay Mines Ltd. entered into an option

agreement with Canico to further explore and develop the property. During 1979 and 1980, Echo Bay completed 664 m of decline, 7,040 m of underground drilling and had shipped 36 t of ore for metallurgical testing. In November, 1980, Echo Bay exercised the option and purchased the property. Production milling of stockpiled ore commenced in April, 1982, with full underground production at a rate of 860 tpd beginning in January, 1983.

Several stages of increased mill throughput have been achieved and the present rate of milling stands at an average of 1,600 tpd for 1986 year-to-date.

REGIONAL GEOLOGY

STRATIGRAPHY

The northern Contwoyto Lake area is underlain predominantly by Archean metasedimentary and volcanic rocks and their gneiss and schist equivalents. All are intruded by Archean granites and Proterozoic diabase dykes. The metasediments and volcanics have been correlated with Yellowknife Supergroup rocks in the Yellowknife Bay area by L.P. Tremblay (1976).

Bostock (1965) divided the sediments of the region into four formations: Point Lake, Contwoyto, Keskarrah and Itchen. It is the Contwoyto Formation sediments which host the Lupin gold deposit.

The Contwoyto Formation is primarily a turbidite succession with an apparent thickness of 6,100 m and consists of argillites, greywackes, impure quartzites and amphibolitic iron formations. The metamorphosed equivalents of these rock types are nodular cordierite, andalusite and sillimanite schists and gneisses.

STRUCTURE

The Contwoyto Formation rocks have been moderately to intensely folded along two principal axes: one trending north-northwest and the other trending northeast to north-northeast. Bedding dips are steep, commonly 65° to 85°. Within greywacke beds, graded bedding and flame structures can be used for stratigraphic top determinations.

The principal fault in Contwoyto Formation rocks in the northern Contwoyto Lake area is the Norma Fault. It can be seen as a faint lineament on air photos and LANDSAT images. The fault is right-lateral with an apparent horizontal offset of 1.5 to 3 km.

REGIONAL METAMORPHISM

In the northern Contwoyto Lake area, regional metamorphism ranges from greenschist to amphibolite facies. Isograds are delineated by formation of cordierite or sillimanite. Higher grade contact metamorphism is seen around granitic intrusives.

MINE GEOLOGY

STRATIGRAPHY

The stratigraphic unit which hosts gold mineralization at Lupin is an amphibolitic iron formation, in part sulphide-rich, which makes up a portion of the Contwoyto Formation sedimentary sequence. Stratigraphic footwall rocks consist of interbedded impure quartzites and argillites. Overlying the iron formation is a unit consisting primarily of argillites with local thin arenaceous beds.

Gold is associated with sulphidic iron formation at Lupin; hence, the classification used is based on whether the iron formation is a sulphide-poor or a sulphide-rich amphibolitic rock. At Lupin, an arbitrary classification defines sulphide-rich amphibolite as that which contains more than 5% sulphides. In some areas of the mine, sulphide content in the iron formation can approach 30%. Gold is related principally to the presence of pyrrhotite.

The amphibolitic iron formation at the mine ranges in thickness from 1.5 to 20 m and has been followed over a strike length in excess of 1,700 m. Chert layers and minor amounts of argillites and argillaceous quartzites are occasionally interbedded with the iron formation. Taken as a sequence, the transition from predominantly impure quartzites in the footwall, through interbedded quartzites and argillites, iron formation, argillites and back into impure quartzites in the hangingwall, suggests a change in the depositional setting of the sediments from moderately high current velocities (quartzites) to extremely low current velocities (iron formation) and back again.

STRUCTURE

Bedding in the vicinity of the mine is generally steep, usually greater than 75°. Two major fold axes are present, one of which trends north-northeast to north-northwest; the other trends northeast. The interaction of the different folding events has resulted in a complex pattern at the mine and in the areas around the mine. The most pronounced fold pattern is that of the gold-mineralized iron formations of the mine itself and these form an "M" or "Z" shape in plan view. The three currently active production areas of the mine, the East, Center and West zones, are all portions of the same iron formation unit folded into a tight anticline/syncline couple.

Results of recent work at Lupin now suggest that the unit hosting the L15, L-16, L-18 and L-25 showings is the same unit as that hosting the mine stratigraphy and the L-19 showing. This conclusion was reached after examining diagnostic stratigraphic top indicators in drill core and in outcrop. Good graded bedding, arkose-argillite couples and flame structures are all well preserved in the greywacke sequence. Metamorphic

deformation within the iron formations, however, has obliterated most original bedding features.

The Lupin Mine stratigraphy is cut by two directions of faulting. The principal of these orientations is northerly trending and movement is left-lateral. One of these faults has displaced the L-19 zone about 170 m horizontally. Another of the northerly trending faults runs parallel to the West zone and its presence is indicated by slickensides on faces along iron formation/greywacke bedding contacts. A second, minor fault direction strikes northeasterly through mine stratigraphy.

MINERALOGY OF ORE

The iron formation unit within which gold occurs is predominantly a well-banded, amphibole-quartz-sulphide rock, occasionally containing garnet and pyroxene. Cross-cutting late quartz veins are common in the ore-bearing zones. Hornblende is the principal amphibole product of grunerite, the amphibole which predominates in iron formation units not containing gold.

The principal sulphide is pyrrhotite with arsenopyrite, minor pyrite and chalcopyrite also present. Sulphide content in the rock can approach 30%. Pyrrhotite is commonly fine grained and well banded, but can also appear as blebs associated with late stage quartz veining. The arsenopyrite is also associated with late stage quartz veining and often forms a halo around the veins, decreasing in quantity away from the vein. Arsenopyrite commonly occurs as coarse grained, well formed crystals and may contain cores of loellingite.

Gold at Lupin is closely related to the presence of sulphides and is primarily associated with pyrrhotite, although some gold is also found at, or near, crystal boundaries within the arsenides. Gold occurs most commonly as fine-grained particles, 5 to 50 µm in diameter, within sulphides. Despite the fine-grained nature of the gold, Lupin ore is free milling and does not require roasting during the recovery process.

ORE ZONES

The Lupin deposit is arbitrarily divided, for mining purposes, into three zones: the West, Center and East zones. Each of these zones is formed by limbs or folded iron formation. Fold closures join the zones. Mining is taking place over a continuous horizontal strike length of 810 m and gold has been located by drilling over a strike length of approximately 1,000 m.

Each of the three zones dips steeply: the West zone dips east at about 80^0, the Center zone dips 70^0 to 80^0 east and the East zone dips 80^0 northwest. Fold closures joining the zones dip steeply to the northeast at 65^0 to 70^0.

The Center zone is the widest of the zones and is, on average, approximately 10 m wide. The strike length of the Center zone is a fairly constant 220 m.

The West zone is the narrowest of the three zones, with an average width of about 1.5 to 2 m. Strike length of the West zone is at least 400 m.

The East zone averages approximately 6 m in thickness. On the upper mine levels, the strike length of the East zone gold mineralization is about 170 m; however, gold continuity in the horizontal dimension decreases in deeper mine levels such that, on the 330 m level, strike or ore grade gold mineralization is about 40 m.

The Center and West zones persist to depth at least to the 650 m level. In late 1985, a shaft deepening program was undertaken and by May, 1986, a development drift from the deepened shaft on the 650 m level had successfully been driven along the length of the Center zone to the fold at the north end of the zone. Drilling and sampling have confirmed that the width, strike, thickness and grade of the ore body on the 650 m level are all comparable to upper levels. In 1987, development is planned for the levels between the 650 m and 330 m levels.

MINE PRODUCTION

PAST PRODUCTION

Since 1982, Lupin has produced 1.91 Mt of ore at a grade of approximately 11.41 g/t (2.10 million shorts tons at 0.333 oz/ton).

Yearly productions is as follows:

Year	Tonnes Produced	Average Grade
1982	79,832	11.40 g/t
1983	323,034	12.02 g/t
1984	493,084	12.02 g/t
1985	570,931	11.13 g/t
1986*	438,981	10.66 g/t
TOTAL	1.905,862	11.41 g/t
	(2,100,831 short tons)	(0.333 oz/ton)

*January - September 1986

1985 ORE RESERVES

Published ore reserves at the end of 1985 were 2.78 Mt of proven plus probable ore grading 11.68 g/t (3.07 million short tons at 0.341 oz/ton). By the end of 1986, development and exploration activities will have replaced ore mined and processed during the year.

A NOTE ON GENESIS OF THE DEPOSIT

Lupin is a stratabound deposit in that

gold is confined to a sulphide-bearing amphibolitic iron formation. Sulphides in the iron formation are predominantly well banded and mimic bedding planes, suggesting the character of a syngenetic gold-bearing, sulphidic iron formation. Recent geochemical, petrological and structural studies, however, suggest that gold deposition may not be entirely syngenetic and than an epigenetic stage or phase of gold deposition has also taken place.

Among the points of evidence for this later event is: a strong alteration of grunerite to hornblende in the ore zones; the lack of continuity of individual bands of sulphides along bedding planes; and, the strong vertical continuity of gold values which can be seen as "pipes" or "shoots" of higher and lower grade ore within the ore zones.

Further work must be done before the final word is said on this very interesting, and profitable, gold deposit.

GOLD IN THE BUGOW IRON FORMATION, DISTRICT OF MACKENZIE, NWT

DANIEL P. BUNNER and RICHARD P. TAYLOR
CARLETON UNIVERSITY

The Bugow Iron Formation is a banded, isoclinally folded, auriferous iron formation with similar lithologic and structural characteristics to the Lupin and Homestake gold deposits. The formation is in Archean supracrustal rocks of the Slave Structural Province, approximately sixty-eight air miles northwest of Yellowknife.

Gold was first discovered in the Bugow Iron Formation by A. Bugow in 1945, who was working on behalf of Frederick Yellowknife Mines Limited. The property was acquired in the latter part of 1945 by Andrew Yellowknife Gold Mines and work in 1946 through 1948 outlined seven gold-bearing zones. Individual zones were found to vary from two to fifty feet in width with a known strike length of over four thousand feet. Two of these zones were tested extensively by surface trenching and drilling with E and X-ray core. Significant gold resources were outlined by this work. One zone was found to contain approximately 48,400 tons, grading 0.13 oz/ton Au, with the other containing approximately 20,000 tons grading 0.23 oz/ton Au.

In 1986, Aber Resources commenced a small drilling program on an auriferous zone on the west limb of a major fold. The limb is known to connect with the previously reported zones. A strike length of approximately four thousand feet, has been outlined by mapping and geophysics. The southern extension of the limb disappears in a swampy covered area. Published results from the drilling program are highly encouraging. Assays from the discovery hole returned a weighted average grade of 0.35 oz/ton Au over a width of 29 feet.

The stratabound, amphibole-rich iron formation is intercalated with a sequence of metamorphosed greywackes, quartzites and argillites of amphibolite-cordierite grade. The rocks that host the gold deposit can best be described as stratiform silicate-sulphide iron formation. Underlying the metasediments is a thin conformable volcanic unit of intermediate to mafic composition, that is locally tuffaceous. Precambrian granites (with associated pegmatites and aplites) cut all of the sedimentary and volcanic rocks, and a set of diabase dykes has intruded all sediments.

Gold occurs within the Bugow deposit in native form, with individual grains ranging from 2-60 µm. Most of the gold is found free, interstitial to amphiboles of the gangue matrix, and always spatially related to pyrite. Some gold has been found welded along grain contacts with pyrite, while other gold grains have been found within silicate-rich gangue inclusions contained within arsenopyrite. Loellingite blotches occur within some arsenopyrite; however, unlike the Lupin deposit, gold has not been found spatially related to the arsenopyrite-loellingite contacts. Field and drill core observations, petrography and assay data demonstrate that the gold can be correlated with:

1) the distribution of pyrite and minor pyrrhotite within an oxide-poor host, and the pyrite-rich sections having a stratiform character; and,
2) the distribution of arsenopyrite, quartz lenses and blotches in a relatively oxide-rich, stratiform, pyrite-rich host.

A similar style of mineralization has been reported at Lupin Mine, with the only differences being that the main sulphide in the Lupin deposit is pyrrhotite, and that the arsenopyrite is related to quartz veins exhibiting definite cross-cutting relationships.

Textural evidence and field mapping tends to support a syngenetic model for gold mineralization at Bugow. A tentative genetic model includes the precipitation of iron, sulphur, gold and copper within chemically derived sediments close to a hydrothermal discharge source in an anoxic marine environment. Deposition is thought to have occurred during a hiatus in turbidite formation. Remobilization and replacement of iron sulphides appears to have been accompanied by introduction of arsenic and quartz during a metamorphic event related to the isoclinal folding of the Bugow Formation.

Our ongoing studies are aimed at resolving which, if either, of the two generally accepted processes (syngenetic or epigenetic), was pre-eminent during the genesis of the Bugow deposit.

RADIOACTIVE GRANITES OF THE NUELTIN LAKE AREA, NWT: GEOPHYSICAL SIGNATURE AND MINERALIZATION POTENTIAL

B.W. CHARBONNEAU
GEOLOGICAL SURVEY OF CANADA

Airborne gamma ray spectrometric surveys published in 1978 outlined an area of radioactively anomalous granitic rocks in the southern District of Keewatin, NWT, and provided an additional geophysical parameter for geological mapping and mineral exploration to the aeromagnetic and gravity coverage already available.

Results of ground investigation of four anomalies in 1982 were originally reported at the Geological Survey of Canada Current Research Forum in January, 1985. Further field study took place in 1985 and a paper reporting on mineralization relating to the above anomalies was published (Charbonneau and Swettenham, 1986).

The four anomalies investigated relate to:

1) Th-REE concentrations in Nueltin granite;
2) Au-U-Mo-W-Co concentrations in calc-silicate float overlying a magnetic anomaly adjacent to a uraniferous tourmaline-bearing granite (Sandybeach Lake);
3) U-Mo enriched granite; and
4) a granite body with a surrounding magnetic anomaly related to iron formation preserved in the margin of the granite.

This work demonstrates the role that gamma ray spectrometry can play in integrated geophysical interpretation for a variety of metals.

REFERENCES

Charbonneau, B.W. and Swettenham, S.S., 1986: Gold occurrence in radioactive calc-silicate float at Sandybeach Lake, Nueltin Lake area, District of Keewatin; in Current Research, Part A; Geological Survey of Canada, Paper 86-1A, p.p. 803-808.

A MINERAL DEVELOPMENT AGREEMENT FOR THE NWT

AL CLARK
ENERGY, MINES AND RESOURCES MINERAL POLICY

Discussions among officials of Energy, Mines and Resources, Indian Affairs and Northern Development, and the Territorial Government have led to a proposal for a mineral development agreement (MDA) between Canada and the Northwest Territories. Federal and Territorial Ministers have not yet considered this proposal and therefore no funds have been committed.

The proposed MDA mirrors the format of most of the agreements EMR has signed with the provinces. There are now MDAs with all of the provinces except Alberta and also one with Yukon. The total federal commitment to these agreements is almost $140 million. This when combined with the total provincial and territorial funding of almost $110 million, means just short of $250 million is being spent to promote mineral development across Canada.

The MDAs are subsidiary to Economic and Regional Development Agreements or, in the case of Yukon and Northwest Territories, Economic Development Agreements, which are umbrella or enabling federal-provincial agreements. These agreements provide for joint identification of priorities for economic development assistance.

The proposed Canada-Northwest Territories MDA has been the subject of extensive consultation with the mining industry and other interested parties. It will be dominated by a geoscience program designed to stimulate private sector exploration expenditure. It will augment the geoscientific information available to mining companies on areas of potential mineralization and compliment the existing programs of the GSC and the Geological Division of DIAND. A Northern Technology Assistance Program (NTAP) will provide assistance to industry to investigate and develop innovation technology to address specific problems in northern mines. This program is designed to make the northern mines more competitive in the marketplace. A Northern Mining Information Program (NMIP) will create greater awareness among the residents of the Northwest Territories about the economic importance of the mining industry.

STRUCTURE OF THE CAMERON RIVER BELT, FENTON LAKE AREA, NWT

RANDAL D. CULLEN, W. K. FYSON
UNIVERSITY OF OTTAWA

Mapping of the Cameron River Belt in the vicinity of Fenton Lake was carried out under a contract with Indian and Northern Affairs Canada, Geology Division, during the summers of 1985 and 1986. The field work was to determine the nature of the change in trend of the volcanic rocks on the eastern shore of Fenton Lake, herein referred to as the Fenton 'Elbow'(Fig. 1). The Elbow marks the change from a northeasterly to a northwesterly trend in the volcanic rocks.

Regional Geology

The volcanic rocks along the eastern shore of Fenton Lake overlie a granitic terrain to the east and are steeply dipping to overturned towards the west. The granitic rocks are, in part, basement to the Yellowknife supracrustals (Sleepy Dragon Complex) and younger than the volcanics, and

partly, intrusive into both the volcanics and the Sleepy Dragon Complex (Morose Granite). The contact between the Sleepy Dragon Complex and the overlying volcanics is marked by alteration in the volcanic rocks and the presence of pyrite and pyrrhotite.

Approximately midway across the volcanic pile a unit of quartz-eye porphyry, interpreted to be felsic tuff, outcrops in the low-lying areas and along the lake shores.

The volcanics are overlain by the meta-turbidites of the Yellowknife Basin to the west. The poorly exposed contact between the volcanics and the meta-turbidites is marked by alteration in both rock types. The whole package has been deformed and metamorphosed through the upper greenschist facies to the low pressure amphibolite facies (cordierite grade).

Structural Geology

The volcanic rocks may have been emplaced along the trends of two fracture systems: one trending northwest; the other trending northeast, marginal to the granitic/gneissic terrain to the east. These orientations are indicated by the pillow-facing directions in the volcanic rocks and by the foliation front near the change in trend where northeast trends in structure and stratigraphy are abruptly replaced by northwest trends.

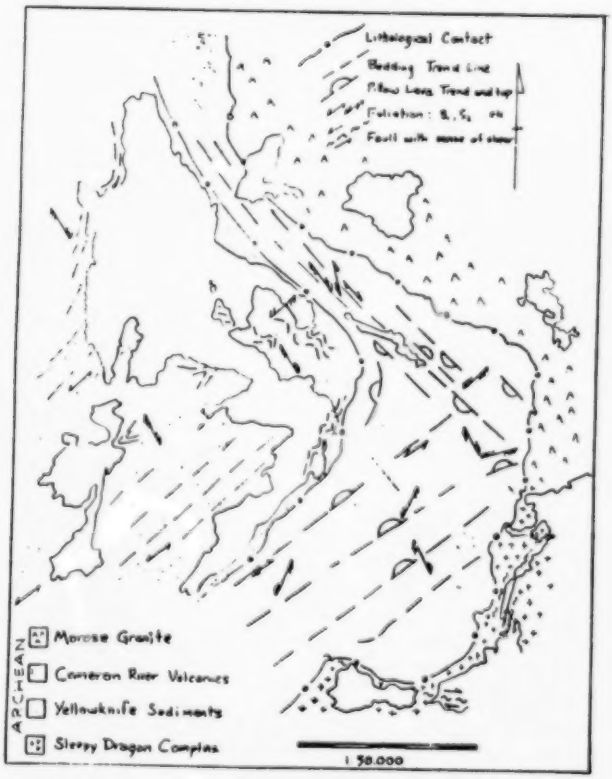

Figure 1. Map of the Cameron River Belt in the vicinity of Fenton Lake.

The trends of the volcanic rocks reflect the orientations of most of the major folds and early foliations in the area. Folds described as F1 and F2 can be associated with the steepening of the dips in the area to near vertical in the northwest-trending arm of the volcanics, and overturned in the northeast-trending arm.

The earliest deformation, D1, appears to be related to the steepening of the dips in the northeast-trending arm and the formation of a marginal syncline along the western boundary of the volcanics. Pillow lavas of the northwest-trending belt were flattened, probably accompanied by the steepening of the belt, and the formation of a northwest-trending syncline in the adjacent sedimentary rocks.

Further steepening in the northeast-trending arm during D2 deformation caused the overturning of the volcanics towards the west and the generation of isoclinal to open folds in the sedimentary terrain. The syncline parallel to the northwest-trending arm of the volcanics was refolded. S2 foliation strikes northeast in both sedimentary and volcanic rocks. The asymmetry of folds in the sedimentary rocks, described as F3, indicates an opening of the limbs of the elbow by D3 compression oriented northeast-southwest. The foliation that accompanies the F3 folds is penetrative in all the lithologies in the map area. In the sediments and the volcanic rocks this foliation is a crenulation cleavage.

The latest stage of deformation, D4, is defined in the volcanics by a northeast- to east-trending foliation that cross-cuts earlier structures and is axial planar to open outcrop-scale folds. An S4 foliation is restricted to the area where the belt changes in trend along its eastern margin.

In the basement granitic terrain east and south of the Fenton Lake area (the Sleepy Dragon Complex), faults marked by mylonite zones trend both parallel and perpendicular to the contact with the overlying volcanics. Movement on the east-trending fault at the south end of the map area, indicated by asymmetry of folds and fabrics within the mylonites, is dextral (east-directed). Faults that parallel the contact and trend north appear to have dextral shear. Fault shear sense and steep, west-plunging lineations in both granite and volcanics indicate the volcanics may have been thrust over the Sleepy Dragon granite. The timing of this event within the deformation sequence is uncertain.

PRELIMINARY METALLOGENIC RESOURCE EVALUATION OF PROPOSED NAHANNI NATIONAL PARK EXTENSION, RAGGED RANGES, NWT

KENNETH M. DAWSON
GEOLOGICAL SURVEY OF CANADA, VANCOUVER

Qualitatively, mineral deposits of the

three following types are most likely to occur in the assessed area: (1) W-Cu (Zn) skarn deposits in a belt of lower Cambrian limestones that extends southeastward from Tungsten; (2) Zn-Pb-Au (W, Au) skarn and replacement deposits in the same belt and host rocks; and (3) carbonate hosted Zn-Pb deposits (Mississippi Valley type), hosted by several lower Paleozoic carbonate units throughout the assessed area.

Deposits of the following three types are likely to occur: (1) granitoid pluton-related quartz-Au-As veins; (2) sedimentary exhalative stratiform Zn-Pb (Ag, Ba) deposits (Howards Pass and Macmillan Pass types) in lower Paleozoic shales; and (3) stratiform sediment-hosted Cu(Ag) deposits (Redstone type) in late Proterozoic clastics in the Thundercloud Range.

Deposits of two additional types may be present in a study area: (1) granitoid pluton-related Li, REE- and U-bearing veins, stockworks and skarns; and (2) stratiform banded jasper-hematite iron formation (Crest type) in late Proterozoic glaciogenic clastic rocks in the Redstone Plateau.

ECONOMIC MINERALOGY OF THE NORTH T-ZONE DEPOSIT THOR LAKE, NWT

L. de ST. JORRE and D.G.W. SMITH
UNIVERSITY OF ALBERTA

The Thor Lake north T-zone deposit, 100 km southeast of Yellowknife, NWT, contains economically significant concentrations of beryllium, yttrium, rare earth elements, niobium, zirconium and gallium. The rare metal mineralization is related to albitization and greisenization of peralkaline granite, which forms an integral part of the Aphebian Blatchford Lake alkaline intrusive complex. Within the T-zone are several strong alteration zones, which can be subdivided into four distinct lithologic units designated: the Wall, Lower Intermediate, Upper Intermediate and Quartz zones. Textural and mineralogical relationships suggest that the zoned alteration assemblages of the north T-zone represent a series of pulsational metasomatic events, including an early alkalic stage of potassium and sodium metasomatism and a later stage of silicification.

The mineralogy of beryllium, the principal metal of economic interest in the T-zone, is relatively simple with most of the beryllium occurring in phenakite. Bertrandite, gadolinite and a member of the helvite group are minor contributors to overall beryllium-enrichment. Beryllium mineralization is most abundant in the Upper and Lower Intermediate zones.

The mineralogy of by-product mineralization in the T-zone is considerably more complex than that of beryllium. Nine Y- and REE- bearing minerals have been identified. Xenotime appears to be the most abundant yttrium-bearing mineral and is typically intimately associated with yttrium-rich thorite. Gadolinite is of minor economic significance. Yttrium mineralization occurs predominantly in the Upper Intermediate zone.

The most abundant REE-bearing minerals are the LREE-enriched fluorcarbonates: bastnaesite, parisite, roentgenite and synchysite. These phases typically occur as syntaxial intergrowth, with two, or occasionally three, present together in a single polycrystal. The fluorcarbonates are ubiquitous in the T-zone, but are most economically significant in the Upper Intermediate zone. Monazite, also LREE-enriched, and britholite are not of economic importance. MREEs are present in the yttrium-bearing minerals, xenotime and gadolinite.

Niobium mineralization occurs mainly in the Lower Intermediate and Wall zones. Columbite is the most abundant niobium-bearing mineral; ashanite occurs rarely.

Three types of zircon have been identified in the T-zone: bipyramidal; zonally metamictized; and overgrowths on xenotime. Zircon is the only zirconium-bearing phase present in the T-zone and appears to be of limited economic significance.

Gallium occurs in albite and K-feldspar, where it is substituting for Al and locally triggers a brilliant blue cathodoluminescence. Economic concentrations of gallium are confined to the Wall zone.

Microbeam techniques, including electron microprobe analysis, scanning imagery, ion probe analysis and cathodoluminescence microscopy, were of invaluable use in the investigation of the complex mineralogy of the north T-zone rare-metal deposit.

PRIMARY STRUCTURES IN ARCHEAN VOLCANIC AND SEDIMENTARY ROCKS OF THE YELLOWKNIFE SUPERGROUP: DATA FROM DETAILED STUDIES OF THE 'GIANT SECTION', YELLOWKNIFE BAY, NWT

J.A. DONALDSON
CARLETON UNIVERSITY

A succession of Archean flows, sills and intercalated sedimentary units of the Yellowknife Bay Formation is remarkably well exposed in the 'Giant Section', about 3 km north of Yellowknife. A great diversity of primary structures are being studied by mapping at various scales, including a scale of 1:10 in several key areas. Compilation at 1:10 allows documentation of numerous physical attributes of flows, flow breccias and associated epiclastic and volcaniclastic units not readily apparent either through mapping at less detailed scales, or by visual inspection of outcrops. The detailed maps

were prepared by establishing grids of one-metre squares, and photographing each square with a 35mm camera equipped with a wide-angle lens and a right-angle prism extension attached to the viewfinder. Projection of coloured transparencies on to a gridded base map on an adjustable table allows easy correction for distortion due to outcrop irregularities, so that maps thus produced are more accurate than comparable maps tediously prepared by plane-tabling.

Some of the most significant observations relate to criteria for establishing the direction of flow in pillowed mafic volcanic units, including: imbrication, consistent asymmetry of pillow outlines, breached selvages, incomplete budding, flow wrinkles on selvages, and rotation of pillows containing tabular drainage cavities. Numerous gas-release channelways in flow breccias locally display upward branching and downflow tilting analogous to inclined pipe vesicles in associated massive flows. Irregular epidote-rich pods along the base of several massive flows are interpreted as infilled spiracles.

Sandstone dykes that transect pillowed flows show local evidence of forceful injection from underlying intercalated beds, but much of the clastic detritus appears to have washed into fissures that developed in a tensional regime. This observation supports previous interpretations of eruption of the Yellowknife Bay volcanic rocks during an episode of sea-floor spreading.

THE N-81 OREBODY AT PINE POINT, NWT

SANDRA FOSTER
UNIVERSITY OF ALBERTA

The N-81 orebody at Pine Point, NWT, on the south shore of Great Slave Lake contains approximately 3 Mt of ore grading 12% Zn and 7.0% Pb.

The ore deposits of the Pine Point district are of the Mississippi Valley Type and are hosted by a Middle Devonian "barrier complex", which developed along the northern margin of the Elk Point evaporitic basin.

N-81 is a typical "prismatic style" orebody consisting of two penetrative lobes of vertical dissolution which have stoped upward into the younger platform carbonates. The base of these penetrative lobes lies within a karst system.

N-81 is a deep orebody by Pine Point standards, being covered by 20 m of overburden and up to 20 m of caprock. This is in contrast to subcropping orebodies further east along the barrier. Due to its stratigaphic position, N-81 provides a unique opportunity for the study of a complete prismatic orebody, unaffected by glacial erosion.

Ground preparation for ore deposition began with the development of a permeable subterranean karst system in the Sulphur Point Formation, during a pre-Watt Mountain period of uplift and emergence. These karst systems were periodically rejuvinated; dissolution and collapse are observed in younger strata up to and including the Slave Point Formation. Once established, these Karst systems controlled subsequent movement of groundwater, and acted as conduits for fluids introducing metals and late stage carbonate. Mg^{2+}-rich brines generated in a peritidal evaporite sabkha in the Watt Mountain period caused extensive dolomitization of the underlying carbonate sequence. This period of diagenesis also saw the development of a brine/oil reservoir in the Sulphur Point Formation dolostones. Subsidence of the marine MacKenzie Basin expelled metalliferous stratafugic brines up-dip into the Sulpher Point reservoir, where bacterial degradation of oil and sulphates was taking place. This bacterial degradation was destroying the fabric of the evaporitic sediments of the Sulphur Point and Watt Mountain Formations and generating solutions and gases rich in sulphur-bearing species.

The penetration of metal-rich stratafugic brines into the oil-water-sour gas reservoir resulted in the precipitation of base metal sulphides within the voids of the system. Bacterial degradation of sulphates continued in the geochemical cells and original anhydrite was replaced by carbonates; the carbonate pseudomorphs being coated by overgrowths of sulphides.

TOPONYMY, MAPPING AND THE GEOLOGIST: 144 YEARS IN CANADA

RANDOLPH FREEMAN, TOPONYMIST
DEPARTMENT OF CULTURE AND COMMUNICATIONS
GOVERNMENT OF THE NORTHWEST TERRITORIES

This paper places the development of policies and procedures for geographical naming in the Northwest Territories in perspective by examining: 1) the nature of the Science of Toponymy; 2) the historic role of the geologist in the naming of geographical features in Canada; and 3) the policies and procedures of the Canadian Permanent Committee on Geographical Names. Beginning in the early 1840's the work of the geologist, and especially those employed by the newly formed Geological Survey of Canada, was seriously hampered by the lack of topographic maps for many of the areas being examined. These early geologists, by necessity, produced topographic maps which included geographical names they had either gathered from local sources or which they themselves had applied to geographical features. The inconsistency of the names shown on maps produced both by the Geological Survey and other government departments precipitated the formation of the Geographic Board of Canada in 1897. This board, which is now known as the Canadian Permanent Committee on Geographical Names, was formed in order to standardize the naming of

geographical features in Canada. The naming policies currently being developed for the Northwest Territories, as is the case for many other naming jurisdictions in Canada, are based on the Committee's policies.

THE HABIT AND TIMING OF QUARTZ VEINS RELATIVE TO FOLDS AND CLEAVAGES IN THE YELLOWKNIFE SUPRACRUSTAL DOMAIN

W.K. FYSON
UNIVERSITY OF OTTAWA

Quartz veins changed habit of formation during progressive deformation and metamorphism of greywacke-argillite in the Yellowknife supracrustal domain. The veins formed during a progression from steeply plunging, predominantly large-scale early folds (F1 and F2) to small, outcrop-scale, later folds (F3), that were accompanied by axial planar cleavages (S3).

The first veins lie parallel to bedding, are confined to argillaceous units (or metamorphic equivalents), and typically are multiple, consisting of overlapping lenses of quartz. Some form saddle reefs restricted to hinge areas of F1 folds, a few thicken around hinges of later folds, whereas others continue beyond the limits of any single fold. Emplacement of most of the bedding-parallel veins before or during F1 folding is suggested.

The second main type of vein predominantly lies, like the first, stratabound within argillites, but oblique to bedding in echelon sets. Asymmetry of echelon sets and folding about S3 cleavage indicates an early F3 origin due to bedding-parallel shear as beds rotated towards the cleavage.

A third type, the axial-planar or foliation vein, is most prominent across sandstones. A few thick veins extend over 100 m parallel to F1 axial surfaces. More common are minor discontinuous veins following S3 cleavage and F3 axial surfaces. Boudinage of the veins indicates emplacement before S3 was fully developed. Sporadic transgressive veins, lying discordant to bedding and cleavage, vary in habit; some change direction where passing from sandstone to argillite beds as if reoriented by flexural shear during F1 folding, some are folded about S3, and others appear undeformed. Evidently the transgressive and other irregularly oriented veins were emplaced at various stages, from during F1 folding until deformation ceased.

The change from argillite as the preferred host rock for bedding and echelon veins to sandstone for foliation veins could reflect conditions of high fluid pressure and the migration of loci of hydraulic fracturing; hence vein formation as fluid was produced and lost during metamorphism. Bedding and foliation veins apparently followed planes of weakness (bedding fissility and cleavage), whereas the echelon vein arrangement reflects an intermediate stage of bed rotation during which the argillites acted as shear zones. Each of the main types of veins could have formed during subhorizontally directed tectonic compression.

HIGH MAGNESIUM OR KOMATIITIC PERIDOTITE FROM THE ARCHEAN HOPE BAY VOLCANIC BELT, SLAVE PROVINCE, NWT

WALTER A. GIBBINS, DISTRICT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM

Ultramafic rocks in the northern Hope Bay Volcanic Belt, originally noted and described in mineral exploration reports as peridotite, are high magnesium peridotites (MgO 25-35%), which fall within the ultramafic komatiite field when plotted on a Jensen diagram. These were the first Archean rocks of komatiitic affinity documented from the Slave Province, although such rocks might be expected from their presence in most Archean shield areas.

Several north-trending, slightly discordant sills of serpentinized peridotite are present northeast of Hope Bay (68°10'N, 106°42' to 106°45'W). The largest of these is 200 to 300 m wide, but most are less than 50 m in width. They have been traced for 2 km along strike. One additional outcrop of peridotite, near the Koignuk River, is some 30 km to the south at 67°58'N, 106°34'W. Although komatiite flows have not been found in the Hope Bay area, it is possible that the peridotites are part of the Hope Bay volcanic package and may represent conduits that fed komatiitic flows. Intrusion during a time when geothermal gradient or temperature was high is indicated by sharp contacts with little or no evidence of metamorphism, alteration or chilling (as well as theoretical considerations). At least two of the sills have well defined apophyses or tongues extending into country rocks. Some of the smaller lenses, however, are sheared internally and along contacts not unlike small serpentinite lenses in the Franciscan terrane of California.

In addition to high magnesium contents, the Hope Bay peridotites have high chromium (1315 to 4280 ppm) and nickel (840 to 1460 ppm) and low TiO_2 (0.15 to 0.48%). A calcium to aluminum ratio near unity indicates a chondritic composition, i.e., a primitive or mantle source. Highly compatible magnesium, nickel and chromium suggest differentiation by olivine fractionation in a near-surface cooling unit. Tight, linear plots of FeO/TiO_2 versus $MgO/TiO_2/Al_2O_3$ indicate that little or no chemical alteration has taken place. An initial MgO content of 46 to 48% and olivine composition of Fo=88 can be estimated from extrapolating plots of incompatible elements (Al, Ti, V) versus MgO.

Coarse to very coarse poikilitic crystals of clinopyroxene are the most common mineral species. Orthopyroxene and olivine are the next most abundant. Olivine varies considerably in size and habit - from large elongate, often corroded, crystals to small islands in clinopyroxene or in alteration products. Minor plagioclase (now fine grained chlorite and garnet) is present, along with serpentine, talc, basaltic hornblende and phlogopite.

Komatiitic rocks like those of the Hope Bay area typically occur in mineral-rich Archean volcanic belts, for example the Abitibi and Yilgaran belts.

PLATINUM GROUP ELEMENTS IN THE NWT: EXPLORATION AND POTENTIAL

WALTER A. GIBBINS, DISTRICT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM

An impressive increase in the price of platinum, from US $260 a year ago to as high as US $675 in early September, has sparked an impressive increase in interest in platinum group elements (PGE) in the Northwest Territories and other parts of Canada. Gold and platinum now account for most, if not all, of the new mineral exploration projects in the NWT. In 1986, Equinox Resources Ltd. and Platinum Exploration Canada Inc. staked claims covering the Muskox Intrusion. Others staked in the Perry River area, parts of the Duck Lake sill, east of Yellowknife, the Rankin Inlet serpentinite and Ferguson Lake amphibolite; all rocks with PGE potential. It is possible that other projects could be in the planning or staking stage. In 1986 the nickel-copper and PGE potential of ultramafic rocks at Rutledge Lake were explored by drilling.

Platinum group elements are almost exclusively found in iron- and magnesium-enriched igneous rocks: ultramafics such as peridotite, pyroxenite, dunites, komatiites. They also tend to be enriched in the sulphide mineral phases in these rocks and correlate with zones high in chromium or nickel-copper. Most Canadian PGE production has come as a by-product of the mining of nickel-copper deposits of Sudbury, Ontario. The only NWT production was a by-product from the Rankin Inlet mine, which operated in the late 1950s. In 1957, proven ore reserves at this mine amounted to 460,000 tons of 3.3% Ni, 0.8% Cu, 0.03 oz/ton Pt and 0.06 oz/ton Pd.

In addition to the ultramafic rocks in areas recently staked, there are many other ultramafic bodies in the NWT. Many of these have been known for a considerable time; eg. many traditional carvingstone sites are in ultramafics altered to serpentinite or soapstone. A considerable number of ultramafic rock units have been recognized and mapped in the NWT by government and company geologists within the last decade or two and undoubtedly many more remain to be discovered. There are numerous ultramafic bodies that deserve to be re-assessed for their platinum potential in light of current economic and political conditions.

GEOLOGY OF THE HOPE BAY VOLCANIC BELT, NORTHEAST SLAVE PROVINCE, NWT

WALTER A. GIBBINS, DISTRICT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM
AND
RANDAL CULLEN
UNIVERSITY OF OTTAWA

The Hope Bay Volcanic Belt comprises a steep syncline with near vertical limbs that extends at least 75 km in a S 10^0E direction from Hope Bay and averages 20 km in width. It consists of a bimodal volcanic package that is dominated by andesite pillow lavas and meta-gabbro dykes and sills in the lower two thirds of the section. The upper part or core of the syncline is characterized by a remarkable variety of felsic pyroclastic rocks with minor sediments (conglomerates, cherts, black shales, siltstones and reworked pyroclastics). It is best developed in the vicinity of Hope Bay. In the area northeast of Hope Bay, near the top of the andesites, distinctive chocolate-brown weathering magnesium-rich komatiitic peridotites form thin sills that intrude the volcanic package. The volume and diversity of felsic volcanics, as well as granite and felsite clasts in some of the conglomerates, imply a granitic crust in the area at the time of volcanism. Granites and granitic gneisses envelop the volcanic belt and generally appear to be younger. An unusual felsite unit is present on several islands in northern Hope Bay, however, its significance is problematical. Proterozoic topographic lows are indicated by outliers of basal Goulburn Group conglomerate and trough cross-bedded quartzite. Several large Franklin diabase dykes and sills form spectacular cliffs and ridges that dominate present-day topography.

Greenschist grade metamorphism prevails in the Hope Bay belt, but amphibolite and higher grades are developed near the margins of the belt in conjunction with granitic intrusion and deformation related to those granites. The western margin of the belt coincides with a large mylonite zone marked by a series of small elongate lakes and creeks. A second, parallel fault is suggested by the trend of the Koignuk River and the lake it drains. The straight course of this river is particularly significant, insofar as it traverses a flat glacial lake bottom.

The sediments and pyroclastic rocks exposed in the centre of the northern part of the belt in the Hope Bay area are isoclinally folded. Black shale units typically feature transposed bedding. Cleavage, kink folds, and gash veins represent the last stages of deformation that mainly affected the central part of the belt in the vicinity of Hope Bay.

The eastern margin of the belt is characterized by numerous 0.1 to 2 m wide dykes of granite.

Late east-trending faults reflect the last brittle stages of deformation. They appear to control silver mineralization near the north end of the eastern contact.

The Hope Bay Volcanic Belt was identified and outlined by GSC Operation Bathurst in 1962 (Fraser, 1964). Deposits of native silver were discovered by Roberts Mining in 1967 and 123,637 ounces of silver were recovered between 1973 and 1975. Despite favourable geology, a favourable location near tide water, and past production, neither the geology nor the mineral potential of the Hope Bay belt have been adequately assessed.

Nevertheless, what is known and the similarity to the Abitibi and Yilgaran greenstone belts indicate that the Hope Bay belt has some of the best base and precious metal potential in the Slave Province and certainly the best potential of the Kitikmeot Region of the Northwest Territories.

THE GOLDEN MARLIN PROGRAM: EXPLORATIONS IN THE SOUTH END OF THE YELLOWKNIFE VOLCANIC BELT

G.R. GOLDAK
GOLDEN MARLIN MINES LTD.
GOLDAK EXPLORATION TECHNOLOGY LTD.

Golden Marlin Mines Limited was formed in 1983 specifically to explore the southern end of the Yellowknife Volcanic Belt. Extensive exploration programs have been conducted continiously since 1984 by Goldak Exploration Ltd. acting as Golden Marlin's operator. When the program was conceived in the late 1970's, it appeared probable, from gravity and somewhat fragmentary geological evidence, that the Volcanic Belt continued south and then southwestwards from Kam Point. At a point approximately 5 miles west of the West Mirage Islands, the belt was believed to swing sharply southeastwards along and beside the Mirage Islands and the Expeditor Reefs. The total length of this belt from Kam Point to the Expeditor Reefs is about 20 miles. The basic exploration premise of the Golden Marlin Program was the expectation that major shear zones would occur in these rocks. Some of these shears, like the Campbell Shear, were expected to simply continue southward from Kam Point; it was felt that other shears might independently occur above or below the Campbell Shear.

Most of the area described is underwater, and so a great reliance on marine geophysics was necessary. It was felt that these shear zones could be delineated accurately using high-resolution marine seismic methods. Because of long experience with these methods, the author was confident that if major shears were present on the Golden Marlin properties, the marine seismic techniques would find them. The second part of the exploration plan involved induced polarization surveys along the shear zones deduced from the seismic surveys, with an aim of locating any sulphide concentrations. If initial test work was successful, development of a marine towed-array IP system was envisaged. Overburden drilling was planned as a useful supplement to both the seismic and IP systems.

The original exploration plan has turned out very well. Approximately 4,000 line km of high-resolution marine seismic surveys have been done on the properties. A 40 foot survey vessel, equipped with computer-controlled radar navigation, was used for this work. This system has been able to detect the bedrock through as much as 300 feet of water overlying 300 feet of silty clay. A main end-product of the seismic work is a contoured bedrock topographic map which allows interpretation of shear zones when used in conjunction with individual seismic records.

With this procedure the Campbell Shear has been traced approximately 6 km south of Kam Point, where it is offset by a major northwesterly trending fault. Two major shear zones proceed southwards from the fault; one of which continues to the western tip of the volcanic belt and then reverses and continues another 15 km southeastwards. The seismic interpretations have been confirmed by a small drilling program performed in the spring of 1986. A few very widely spaced holes were drilled into each interpreted shear zone. The drilling provided a complete confirmation of the shear zones.

Having traced the shear zones, it would be possible to simply drill them off on a grid basis. The cost of drilling the shear zones was estimated as approximately $8 million and so some method of selecting the most potential sections of the shear zones would obviously be of great value. The seismic itself can show horses, flexures and bifurcations in the shears. From the experience at Con and Giant mines, these could be regarded as valid targets. Some means of locating sulphide-bearing zones within the shear zones, if feasible; however, would be of enormous significance. To this end, two pilot-study induced polarization surveys were contracted: one in 1985; the other in 1986. These were conventional surveys performed through lake ice. The results were not entirely conclusive, but suggested that IP could be useful. The resistivity of the lake bottom clays was found to be approximately 30 ohm-meters, and was regarded as encouraging.

In 1986 a number of experiments were done using a time-domain dipole-dipole array of CuSO electrodes, towed behind our survey boat. A 50 m spacing was employed and readings were integrated over a 30 m survey line segment. Severe problems were initially experienced with noise and inductive coupling, but after several weeks of experimentation, successful results were

obtained. It is now felt that a detailed IP examination of all shear zones is well worthwhile. With the marine system, approximately 10 line km per day can be surveyed and much more rapidly than on land.

The one non-useful component of the original exploration plan has been the overburden drilling. From the initial seismic data it seemed clear that any till on bedrock was less than 2 m thick. Several Vibra-Wink holes were put down to bedrock in several of the shear zones, but no till was recovered on any of the holes, and the entire survey provided nothing but a confirmation of the accuracy of the seismic work.

A helicopter-borne, radar-navigated magnetic and electromagnetic survey of the northern half of the Golden Marlin properties was done in late 1985. The major shears are too deep, usually 75 to 100 m to bedrock, for an electromagnetic response. The magnetic results were interesting but showed a very strong topographic correlation. A magnetic inversion is planned to effectively remove the effects of bedrock topography and allow the production of a color contoured magnetic susceptibility map.

Clearly this is one of the areas in which underwater exploration techniques can be more effective than those normally used in land-based exploration. Very accurate and very high-quality bedrock topography data can easily be obtained in the marine case, and these can be used to refine interpretations of magnetics and induced polarization to a degree simply not possible on land. The seismic information is obviously of great assistance in drilling as well.

GEOLOGY OF THE HOOD RIVER AREA (NORTHEAST PART OF NTS 76 L)

V.A. JACKSON, PROJECT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM

Archean volcanics and sediments in the Hood River area form the southern part of the High Lake Volcanic Belt, which extends about 90 km to the north. The overall trend of the supracrustal belt is northerly, except for an east-trending apophyses along the Hood River. Structural trends within the belt tend to subparallel the bordering granitic terrane. Metamorphic grade of the belt ranges from greenschist to upper amphibolite, with the higher grade rocks found as gneissic enclaves within granitic intrusives.

Rock types within the area are comparable to those in the northern part of the High Lake Volcanic Belt (Jackson, 1985). In comparison to the northern part of the belt, sediments are less abundant, but a greater volume of intermediate and mafic volcanics is recorded in the Hood River area. Relatively thick accumulations of intercalated intermediate fragmentals, flows, possible intrusive equivalents and minor felsic and mafic volcanics are localized in three main areas. These accumulations may represent volcanic centres, although in one of the areas, the apparent greater thickness may be a result of structural repetition through folding.

Top determinations within the supracrustal belt are rare, but are sufficient to determine a crude stratigraphic order of sediments overlying mafic pillow lavas. In addition, an overall synclinal structure, much modified by pluton emplacement, is suggested for the main part of the belt. Several large folds have been mapped along the western (NTS 76 L/15), southwestern (NTS 76 L/10) and northeastern (NTS 76 L/16) edges of the belt. The contact between a pillow flow unit and metasediments outlines a synform on the east side and an antiform on the west side of a granite pluton (NTS 76 L/15). Shallow-dipping structures adjacent to this pluton, on the west side, suggest the volcanics form a veneer on top of the granite and that the present level of erosion has exposed the roof of the granite.

An arcuate zone of sheared and altered volcanic rocks subparallels the Hood River (NTS 76 L/15) and transects the northwest corner of NTS 76 L/10. The zone is steeply dipping and is slightly discordant to the dominant trend of the volcanic belt. At the northern end of the zone, sheared volcanic rocks appear to grade into less deformed equivalents; the southern limit of the shear zone is not observed as it continues into the area west of NTS 76 L/10. Chlorite, carbonate and sericite are the main alteration products associated with this zone. A similar zone of sheared rocks is found in the northern part of the High Lake Volcanic Belt along the Kennarctic River (NTS 76 M/7; Padgham and others, 1973).

REFERENCES

Jackson, V.A., 1985:
Geology of the eastern Hepburn Island area (76 M); in Exploration Overview: Mining, Exploration and Geological Investigations, Northwest Territories, 1985, eds. J.C.E. Crux and C.E. Ellis; Indian and Northern Affairs Canada, 36 p.

Padgham, W.A., Jefferson, C.W., Hughes, D.R. and Shegelski, R.J., 1973:
Geology of the High Lake area (NTS 76 M/7); GSC Open File 208.

A PRELIMINARY ACCOUNT OF THE GEOLOGY AROUND THE NORTH END OF RUSSELL LAKE, NTS 85 O/4

V.A. JACKSON, PROJECT GEOLOGIST
GEOLOGY DIVISION, NORTHERN AFFAIRS PROGRAM

Supracrustal rocks in the Russell Lake area (85 O/4) form part of the westernmost greenstone belt in the Slave Province, being continuous with the Indin Lake Volcanic Belt to the north. The Russell Lake area is of interest because gold is known to occur in

three geological settings: 1) in iron-rich metasediments (Lupin-type iron formation, eg. BUGOW claims, Cabin Lake); 2) in quartz stockwork associated with sheared metasediments (eg. MAG claims, Gold Island, Mosher Lake, NTS 85 O/3); and 3) in sheared basic metavolcanics (MOS claims, Mosher Lake).

The four major rock types in the area are mafic and felsic metavolcanics, metasediments and granite. Volcanic and granitic rocks were examined briefly during the 1986 summer field season. The metamorphic grade of the area ranges from greenschist to amphibolite facies. A metamorphic isograd has been mapped to define the boundary between the two facies and marks the first appearance of knotted (cordierite) schists.

Roughly 75% of the Russell Lake area is underlain by turbiditic metasediments that, in many respects resemble, the Burwash Formation of the Yellowknife Volcanic Belt. The Russell Lake sediments, however, contain abundant layers of iron formation and, in this respect, are comparable to those of the Point Lake - Contwoyto Lake area. The metasediments have been subdivided into two lithologies: a fine grained, relatively thin-bedded sequence that locally contains iron formation, and a coarser grained, more thickly bedded sequence that lacks iron formation but contains disemminated pyrite. Iron formation, which is found in several localities around Russell Lake, includes red and green argillite layers that may be hematite, magnetite, carbonate, garnet or amphibole-rich and dark grey or black argillites that may contain garnet, chert nodules, magnetite and a variety of sulphides.

Bedding trends within the metasediments are dominantly northerly to northeasterly. Near Cabin Lake, these trends swing easterly and then northwesterly, subparalleling the margin of the granite pluton to the north. Over relatively large areas bedding is easterly facing. Reversals in bedding facing directions document isoclinal folds, which may represent the major episode of folding. In many cases iron formation is found in areas where isoclinal folds have been documented or inferred from these reversals. Axial traces of these folds also subparallel the granite contact. Isoclinal folds have a locally developed axial planar cleavage, but regionally developed cleavage trends are discordant to and thus post-date formation of isoclinal folds. Cleavage trends vary from northwest (counter-clockwise to bedding) to northeast (clockwise to bedding) and easterly. In one location the northwest cleavage trend (preserved in cordierite porphyroblasts) predates the northeasterly trend. The easterly trend is locally developed in the eastern map area, but is pervasive in the vicinity of Cabin Lake, suggesting the cleavage orientation in this area has also been modified by pluton emplacement. Major folding is not associated with regional cleavage development.

NON-RENEWABLE RESOURCE ASSESSMENTS IN WAGER BAY-SOUTHAMPTON ISLAND AND SOUTH NAHANNI RIVER AREAS: A PROGRESS REPORT

C.W. JEFFERSON
MINERAL RESOURCES DIVISION
GEOLOGICAL SURVEY OF CANADA

The two field components in non-renewable resource assessments are: geological mapping, and geochemical sampling of rocks, tills, stream sediments and spring waters. These new field data improve quantification, consistency and confidence in non-renewable resource potential ratings of geological domains.

In the Wager Bay-Southampton Island area, four main geologic domains are considered: widespread tonalitic pink and grey gneisses; a structurally complex supracrustal belt that extends across central Wager Bay; a belt of Hudsonian granites on the west that intrude gneisses and Aphebian (Penhryn Group) strata; and lower Paleozoic carbonate strata on Southampton Island, whose stratigraphic-structural evolution may be similar to that of the Boothia Uplift. Calc-Silicates, marbles and ultramafics in supracrustal belts; two separate oil shales on Southampton Island; and comparison between Bell Arch (Southampton Island) and Boothia Uplift are new aspects that affect resource-potential ratings.

The South Nahanni River area comprises five overlapping geological domains, each with known non-renewable resources: Macdonald Platform (carbonate-hosted lead-zinc), Mackenzie Arch (iron formation and copper), Selwyn Basin (sedimentary-exhalative base metals), Ragged Ranges (skarn and replacement tungsten, precious and base metals), and Mesozoic-Tertiary cover (coal). The region is still thermally active (hot springs). Progress in 1986 includes recognition of features characteristic of nearby mineral deposits (Cantung-W and Vulcan-Ag-Pb-Zn) within proposed extensions to the Nahanni National Park Reserve, and positive evidence for a shallow level pluton suggested by remote sensing.

TOWARDS AN OCEANIC MODEL OF SLAVE PROVINCE TECTONICS

TIMITHY M. KUSKY
DEPARTMENT OF EARTH AND PLANETARY SCIENCES
THE JOHNS HOPKINS UNIVERSITY

Tectonic models for the Slave Province, generally invoke some form of continental rifting in which the volcanic and sedimentary rocks are rift-fill sequences of ensialic geosynclines. The volcanic and sedimentary sequences, however, are unlike those found in more recent continental rifts. Recent mapping in the region has recognized: ophiolite stratigraphy in several "greenstone" belts; and, mylonite and melange

zones between these ophiolites and gneisses, previously interpreted as in situ sialic basement.

Maps and field photos of the Cameron River, Beaulieu River and Point Lake Greenstone Belts will be shown to illustrate the variably preserved ophiolite stratigraphy. The sediments grade downward from thick pillow lava flows into mixed volcanic flows and dyke/sill complexes, locally into sheeted dykes, and, in the Cameron River and Point Lake belts, into massive gabbros. Numerous thin (less than 100 m) ultramafic bodies were found in high strain zones at the bases of these three greenstone belts. The high strain zones separate the greenstone belts from gneissic terranes and, in addition to the ultramafics, contain high grade metasediments, banded iron formation, and schistose mafic rocks. Ultramafic rocks high in the sequence preserve a relict cumulate texture while those near the base of the high strain zone locally retain peridotite textures. They are interpreted as originally forming above and below the petrologic Moho, respectively. The ultramafics are highly deformed, but their stratigraphic position, petrology, and chemistry (Cr, Ni, and so on) suggest an ophiolitic affinity. The generally high Cr values make them promising exploration targets for platinum group elements.

The sedimentary rocks in these high strain zones have several possible modes of origin. They could be: initial rift-phase deposits; or, the result of sedimentation of a "shelf", initially near sea level that was dragged deeper by obduction-related loading. Final emplacement of the greenstones onto gneiss would incorporate the sediments into the high strain zones. Alternatively, they could be deep sea sediments accreted to the base of the greenstone slab during early obduction-related thrusting.

The high strain zones have lithological assemblages remarkably similar to those found in melange complexes of Phanerozoic dynamo-thermal metamorphic aureoles beneath some obducted ophiolites. An economic application of the ophiolite model predicts that platinum-rich, ultramafic rocks will be found at the bases of greenstone belts in the Slave Province.

STUDIES OF SURFICIAL SEDIMENTS IN INTER-ISLAND CHANNELS OF THE CANADIAN ARCTIC ARCHIPELAGO

B. MACLEAN, G. VILKS AND G. SONNICHSEN
ATLANTIC GEOSCIENCE CENTRE
GEOLOGICAL SURVEY OF CANADA
BEDFORD INSTITUTE OF OCEANOGRAPHY DARTMOUTH

Investigations of the geology and geotechnical properties of seabed surficial sediments in inter-island channels of the Canadian Arctic Archipelago were carried out by the Atlantic Geoscience Centre during 1985 and 1986. These studies were funded by the Northern Oil and Gas Action Program (NOGAP).

In 1985, samples of the unconsolidated seafloor sediments were obtained through the ice at 78 stations in the Cameron - Lougheed - Melville Island region, and some shallow seismic profiles and sediment samples were collected from CCGS Des Groseilliers in Austin and McDougall Channels.

Two major field programs were undertaken in 1986. The first involved collection of continuous shallow seismic reflections and other acoustic profiles, and samples from open water leads in the permanent ice cover of the Cameron - Lougheed - Melville Island region. The survey was carried out using helicopter-transported small boats from a temporary base camp on Lougheed Island. Data on the distribution, thickness and types of seabed sediments were obtained in eleven leads, despite unusually unfavourable ice and weather conditions during the summer of 1986. The second program, carried out from CSS Hudson, obtained extensive shallow and high resolution seismic reflection and other acoustic data, and sediment samples in Wellington, Byam Martin and Austin Channels and eastern Barrow Strait. Reconnaissance seismic data and sediment samples were collected in Sophia Channel and parts of northern Viscount Melville Sound.

The data obtained indicate widespread occurrence of unconsolidated sediments of apparent glacial origin, which overlie variably dipping sedimentary bedrock. The glacial sediments are locally overlain by up to a few metres of mainly silty and clayey sediment with some coarser components. Surficial sediment thicknesses in Wellington Channel are commonly 10 m or less, but locally reach 20 m. In Byam Martin and Austin Channels, the surficial sediments are generally thicker, and in eastern Barrow Strait they locally reach 70 m. Profiles from leads surveyed in Desbaraga Strait indicate up to a 50 m maximum thickness of unconsolidated sediment.

Sidescan imagery indicates that seafloor sediments have been modified by ice scour in many of the areas investigated.

FOSSIL FORESTS IN THE FAR NORTH, ARCTIC ISLANDS, NWT

N.J. MCMILLAN
INSTITUTE OF SEDIMENTARY
AND PETROLEUM GEOLOGY
GEOLOGICAL SURVEY OF CANADA, CALGARY

The term "fossil forest" refers to groups or clusters of more or less upright stumps of trees consisting of dried out original wood or petrified wood. Four Lower Tertiary sites on Ellesmere Island contain fossil forests. They are at Vestle and Strathcona Fiords, Judge Daly Promontory, and

Hot Weather Creek area, 20 km east of Eureka. A fifth site is situated 10 km northeast of Geodetic Hills on Axel Heiberg Island. The fossil flora is dominated by Dawn Redwood (Metasequoia). Trunks range from 30 cm to 2.5 m situated 4 to 5 m apart. Underbrush was dense with ferns. Leaf litter is well preserved on a soil which may have been a podzol. Two sites, Hot Weather Creek and Geodetic Hills, contain well in excess of 20 forest stratigraphic levels.

Studies are revealing the paleoclimate and environment of the Arctic during the 40-65 Ma span. Amber and resin are widespread, fossil forest fires are well preserved.

Research is continuing on the resin yield of the forests because petroleum is produced from it after adequate burial.

GOLD SHOWINGS IN ARCHEAN RANKIN-ENNADAI GREENSTONE BELT, NWT

J. NIKHANJ, VICE PRESIDENT, EXPLORATION
BOREALIS EXPLORATION LIMITED

Borealis Exploration has been engaged in mineral exploration in the NWT since 1965. In late 1984, the company's efforts were focused on gold exploration in the Rankin-Ennadai Greenstone Belt, where, following an open file search, Prospecting Permit (PP) 1070 and adjacent claims were acquired in 1985. During 1985-86, gold was found in various geologic environments including:

1) High grade vein-type deposits along major and minor shear zones: high gold assays were obtained from grab samples with abundant free visible gold and over a 1 m intersection. Two holes drilled 10 m apart intersected high gold grades across 4.6 and 1.5 m.

2) Sulphide-rich (exhalite-facies) iron formation: returned grades as high as 0.627 oz/ton (21.50 g/t) Au over 4.6 ft (1.4 m), and grab samples that assayed as high as 1.19 oz/ton (40.80 g/t) Au.

3) Brecciated northwest-trending gabbro dykes: grab samples assayed as high as 0.202 oz/ton (6.93 g/t) Au.

4) Felsic dykes, emplaced along major northeasterly trending arcuate shear zones: gave assays as high as 0.10 oz/ton (3.43 g/t) Au.

During 1986 a number of additional exploration targets were identified on the new prospecting permits (576,764.60 acres), acquired by the company that year. Such targets include:

1) Polymictic and oligomictic pyritic conglomerates of late Montgomery (Archean) or early Hurwitz (Aphebian) Group sediments. Gold was panned at several locations.

2) Banded sulphide/oxide-facies iron formation (gold was panned from the sulphide-facies).

3) Porphyry-type zones of sulphides in mafic intrusive plugs. Gold was panned at one location.

4) Sulphide-bearing quartz veins and dykes. Grab samples yielded values as high as 3.80 oz/ton (130.29 g/t) Au.

5) Sheared volcaniclastics. N[illegible]s and assays greater than 0.25 oz/ton (8[illegible]/t) Au across 4.9 ft (1.5 m) and grab [illegible] of 4.08 oz/ton (139.89 g/t) Au were [illegible]ed on PP 1086 (farmed out to Nobel Peak [illegible]esources, Toronto).

The gold showings are in complexly deformed Archean Kaminak Group volcanics of tholeiitic to calc-alkaline composition and in later intrusives.

BASELINE GEOCHEMISTRY OF TILLS, VICTORIA ISLAND, NWT

F. MARK NIXON
TERRAIN SCIENCES
GEOLOGICAL SURVEY OF CANADA

A coordinated till sampling program was one component of a large mapping project on western Victoria Island, NWT. The program was designed to allow evaluation of the reproducibility of results and of the spatial distribution of variance through analysis of variance techniques. Sample characteristics measured include granulometry, carbonate content, and trace element geochemistry. The data from laboratory analyses are presented in tables and on maps. Analysis of variance indicates that certain variables strongly represent regional variation in till, while others show considerable variability below the scale of sampling density.

Analysis of detailed soil and depth profile samples indicates leaching of carbonates and enrichment of most trace elements in the upper, or more oxidized, material. None of these variations with depth or soil development was sufficiently large to change distribution plots significantly.

The plots are simply a presentation of the data in its geographic context. Using only those plots considered stable from analysis of variance, one can see the close association between till geochemistry and underlying bedrock. Superimposed on the substrate-controlled distribution are features resulting from various processes. Glacial transport has a very important influence on variability but, bedrock source and glacial transport are not the only processes causing variable geochemistry of tills. Age of the surface and texture, resulting from provenance and/or process of deposition, may also play a part.

The information about distribution of variance gained through this sampling program

design is most valuable when using the data and has contributed to a subsequent sampling design in an adjacent area.

A STUDY OF SHEAR ZONE ALTERATION IN THE "MIRAGE ISLAND FORMATION", YELLOWKNIFE BAY

CAROLYN RELF
CENTRE FOR EARTH RESOURCES RESEARCH
DEPARTMENT OF EARTH RESOURCES RESEARCH
MEMORIAL UNIVERSITY OF NEWFOUNDLAND

The Mirage Islands are located 22 km south-southeast of Yellowknife, at the mouth of Yellowknife Bay. The geology of the area is dominated by calc-alkaline volcaniclastic rocks and tuffaceous sediments, striking easterly and younging towards the north. Mafic tuffs and flows comprise about 30% of the exposed section. These rocks are interpreted to be correlative to the Banting Group. Although similar, the Mirage Island stratigraphy cannot be equated to either of the Banting Formations defined by Helmstaedt and Padgham (1985), and has been informally named the Mirage Island formation by the author. Granitoid rocks intrude the westernmost West Mirage Islands, and are interpreted to be related to the Western Granodiorite.

A series of steeply dipping, easterly striking shear zones cut the lithologies on the islands, and are marked by strongly schistose zones 0.5 to 4 m wide. In most cases, the direction and magnitude of offset along the shears is not determinable, although one shear zone displays a horizontal sinstral displacement of 40 cm. Its vertical component of offset is not exposed. The majority of shears occur in gabbro, probably a reflection of the greater competency of the felsic volcanic rocks.

The mineralogy of the various lithologies are compatible with upper greenschist to lower amphibolite grade assemblages. Metamorphic grade increases westward towards the Western Granodiorite. Mafic volcanics and gabbros contain plagioclase (An_{0-45}), chlorite, biotite $\pm$ actinolite $\pm$ hornblende $\pm$ clinopyroxene. Recrystallized felsic volcanics are made up of quartz, feldspar, biotite, chlorite and muscovite. Metamorphic minerals in granitoid rocks include plagioclase (An_{15-35}), biotite chlorite $\pm$ actinolite.

Shear zones display lower greenschist facies assemblages as a result of retrograde metamorphism within them. In places, the shears are intruded by anastomosing veins of quartz $\pm$ carbonate.

The plagioclase-hornblende geothermobarometer of Plyusnina (1982) indicates low pressure metamorphic conditions with temperatures ranging from 500° to 650°C. The Western Granodiorite is interpreted to be the heat source for this contact metamorphism. Within the shear zones, pressure and temperature conditions were at approximate temperatures of 500°C and pressures of 3 kb.

Oxygen isotope thermometry was carried out on quartz-chlorite pairs from within the shears; fluid temperatures and ^{18}O contents were found to lie in three distinct populations: $\pm$ 370°C with $\delta^{18}O$ = +4.3‰.; $\pm$ 450°C with $\delta^{18}O$ = +6.7‰.; and $\pm$ 600°C with $\delta^{18}O$ = +7.8‰. This is interpreted to indicate a mixed source for the hydrating fluids in the shears - a high temperature metamorphic or igneous-derived fluid; a low temperature meteoric source; and possibly a third, intermediate fluid from mid-greenschist facies dehydration.

Water/rock ratios within the shears relative to their unsheared protoliths are in the order of 300:1. Where quartz veins are present, these ratios are much higher. Bulk chemical changes within the shear zones vary - probably as a function of temperature, water/rock ratio, and initial composition of both the fluid and the rock.

Further work on the area will include fluid inclusion studies, to determine fluid compositions and trapping temperatures, and possible ICP-MS analyses for gold, for comparison with the gold-bearing shear zones near Yellowknife.

COMPLEX QUARTZ VEINS AND THEIR RELATIONSHIP TO FOLDS IN ARCHEAN TURBIDITES SOUTHEAST OF YELLOWKNIFE BAY - PRELIMINARY REPORT

D.E. ROACH AND W.K. FYSON
UNIVERSITY OF OTTAWA

RESEARCH OBJECTIVE

Successive generations of quartz veins were recognized by Fyson (1986) in the Archean meta-turbidites southeast of Yellowknife. Veining styles were observed to change in response to the deformation mechanisms which were active during the successive deformation episodes. The present investigation details the tectonic relationship between these quartz veins and the folded Archean metagreywackes. This tectonic relationship will hopefully contribute to the understanding of Archean and Proterozoic deformation processes which were active in the Yellowknife sedimentary rocks.

FIELD WORK

The islands and mainland on the southeast side of Yellowknife Bay were mapped in detail during the 1986 summer field season. The southern extension of the mapping includes the Jackfish Islands, Pilot Islands and the East Mirage Islands. The northern extension of the mapping ties in with the geological map produced by Easton (1982). During mapping, particular attention

was paid to quartz veins and their orientations.

PRELIMINARY RESULTS

The island outcrop provides excellent exposure of the quartz veins and folded meta-greywacke. The southeastern section of the map area is dominated by steeply plunging, west-facing, tight to isoclinal folds. The hinge zones of these folds commonly display a foliation defined by rotated and elongated primary sedimentary structures. Outside of the immediate hinge area, a later foliation predominates; this is non-axial planar and strikes northwest, parallel to the contact with the quartz diorite and granodiorite. This later cleavage is often refracted, by as much as 40°, between the sandstone and argillite beds. Further north, the northwest-striking cleavage is more strongly developed in higher grade metasediments containing porphyroblasts of andalusite and cordierite. Along the eastern contact with a large granodiorite pluton, migmatized sediment is isoclinally folded with axial planes parallel to the northwest-striking contact.

In the central southern portion of the map area, the folding is generally more open, with northeastern axial planar surfaces. Earlier folds face east and west on opposite limbs of a large open fold on the Pilot Islands. Few folds are present in the southwest corner of the map area. These are generally tight and east-facing with an E-W axial surface.

North-northwest trending Proterozoic faults commonly cut both the bedding and foliation. An east-west fault, marked by up to 5 m of tectonic breccia and subparallel to bedding in the metasediments, can be traced for over 7 km. Fabric analysis should indicate whether or not this is an Archean structure.

A variety of quartz veins is present within the metasediments. These include multiple bedding-parallel veins, foliation veins, echelon veins, and transgressive veins as described by Fyson (1986). Preliminary observations indicate that successive generations and types of veins are common within a single bed. The bedding-parallel veins and, less frequently, the echelon veins, are folded about the east-west fold axis. Echelon veins have orientations both in accordance with and in the opposite sense for flexural slip during east-west folding. Transgressive veins are typically oriented in opposite senses from the bedding within argillite and sandstone beds. Bedding-parallel veins, foliation veins, and echelon veins are extremely flattened and boudinaged in the highly foliated metasediment adjacent to the quartz diorite and granodiorite.

A further stage of research will include systematic analyses of vein types and orientations in relation to the larger folds, foliation and strain variations adjacent to the plutons.

REFERENCES

Fyson, W.K., 1986:
A succession of quartz veins in Archean metaturbidites, Yellowknife Domain, Slave Province; GAC/MAC/CGU Joint Annual Meeting, Program with abstracts, p. 70.

SEDIMENT-HOSTED STRATABOUND COPPER AND URANIUM MINERALIZATION IN THE BEAR PROVINCE

MYRON SAWIUK
CENTRAL ELECTRIC GENERATING BOARD
EXPLORATION (CANADA) LTD. (CEGB)

The Dumas Lake copper prospect (116°12'W, 66°30'N) was discovered in July, 1985 during follow-up exploration to locate the source of a glacially transported radioactive boulder. The mineralization resembles the sediment-hosted stratabound copper type, and associated metals include: silver, lead and uranium. It is hosted by a lacustrine and fluvial red bed sequence within the Dumas Group in the 1875 Ma Great Bear Magmatic Zone of the Bear Structural Province.

ECONOMIC GEOLOGY AND MINERALOGY, LAKE-ZONE, THOR LAKE RARE METAL DEPOSITS: REPORT ON 1986 FIELD WORK

D.G.W. SMITH
UNIVERSITY OF ALBERTA

Work over the last three or four years at Thor Lake by Highwood Resources Ltd. and their contractors, and by Louise de St. Jorre (M.Sc., University of Alberta), has demonstrated substantial mineralization of the T-zone with economically interesting concentrations of beryllium, yttrium, rare earth elements, and possibly zirconium and gallium. Exploration work culminated in an agreement in the late summer of 1986 with Hecla Mining Company of Canada Ltd. for the exploitation of these deposits.

Earlier work by Highwood Resources, in collaboration with Placer Developments Ltd., had shown that large tonnages of tantalum and niobium exist in the Lake-zone of the Thor Lake deposits. The fine grained, disseminated nature of the minerals containing these elements, however, pose potentially serious difficulties in their extraction and, by itself, the extraction of these elements would probably not be viable. Interest in the potential of the Lake-zone has been revived, however, with the subsequent discovery of beryllium in the T-zone and also of substantial rare earth elements and gallium values in both the T-zone and Lake-zone.

During the late summer, the contractor's graduate student, Mr. Robert Pinckston, visited Thor Lake to familiarise himself with the whole deposit; in particular the

Lake-zone. As well as spending several days examining outcrop, Mr. Pinckston surveyed the extensive core material now available and selected nearly one hundred samples of Lake-zone material illustrating the nature and range of rock types and the mineralization present. These samples were forwarded to the University of Alberta and forty of them chosen and submitted for polished thin sectioning.

As part of the requirements for a Master of Science degree at the University of Alberta, Mr. Pinckston will examine these samples using transmitted and reflected light microscopy, followed by qualitative and quantitative electron microprobe analysis. These studies will be aimed, not only at the identification of the minerals of economic interest, but also at an understanding of the textural features exhibited by the rocks and their bearing on the genesis of the deposits on the one hand and economic exploitation on the other.

Limited neodymium/samarium isotopic studies may be undertaken to throw further light on the age and genesis of these important deposits.

The information collected will be used to support a thesis to be written by Mr. Pinckston.

THE STRUCTURE AND MINERALOGY OF THE BULLMOOSE LAKE GOLD DEPOSIT

STEPHEN SWATTON
UNIVERSITY OF ALBERTA

The Bullmoose Lake gold property is in the Slave Structural Province, 77 km southeast of Yellowknife, NWT (62°17'N, 112°44'W). It has been developed to the 700 foot level. Most of the ore is being recovered from a series of en echelon quartz veins by shrinkage stoping. Gold occurs in several forms and modes but most commonly as free gold in blue-grey quartz. Locally, very high grade sections contain a variety of sulphide minerals that are closely associated with the gold. Sulphur isotope studies of sulphide mineral pairs suggest the possibility of an early (phase I) depositional temperature in the range of 290-360°C. The results of laboratory studies and fieldwork are integrated into a working model to account for the formation of gold-bearing veins at Bullmoose Lake.

STRUCTURE AND GEOCHEMISTRY OF THE RANKIN INLET GROUP, RANKIN INLET, NWT

SUBHAS TELLA
GEOLOGICAL SURVEY OF CANADA
AND
I.R. ANNESLEY
UNIVERSITY OF OTTAWA

The Rankin Inlet area is predominantly underlain by a deformed and metamorphosed greenstone-sedimentary sequence, the Rankin Inlet Group. The group is comprised of thick successions of massive and pillowed mafic volcanic flows, and interflow sediments (greywacke, quartz-magnetite iron formation), tuff, pyroclastics and volcanic breccia. They are conformably overlain by a thin (approximately 100 m), discontinuous dolomite unit, which in turn, is overlain conformably by a laminated, dirty quartzite unit. At least two cycles of volcanism, with an intervening cycle of turbidite deposition, can be recognized within the Rankin Inlet Group. A highly sheared, discontinuous unit of polymictic conglomerate, consisting of abundant clasts of white orthoquartzite, dolomite, slate, tuff, and rare volcanic and black chert clasts, occurs between the lower and upper volcanic cycles. Ultramafic (komatiitic) sills, locally enriched in copper and nickel, occur within the mafic volcanic sequence. The Rankin Inlet Group is considered to be Archean in age, but definitive geochronology is required to document constraints with certainty.

The greenstone-metasedimentary sequence forms an east-dipping F1 homocline that is folded into a southeast-plunging F2 upright syncline (Tella and others, 1986). The metamorphic grade is within the sub-greenschist to lower amphibolite facies. Strain estimates based on selvage thickness ratios from deformed lava pillows reveal the presence of northwest-trending high strain zones within the volcanic sequence that are commonly associated with high angle thrust faults within the Rankin Inlet Group, and that the stratigraphy of the Rankin Inlet Group by shortened to about 12-23% on the flanks of the major F2 fold (Borradaile, pers. comm.). Stratigraphic younging and structural facing relationships indicate two structural discordances, not coincident with the high-strain zones, within the upper volcanic cycle of the Rankin Inlet Group. These discordances may be interpreted as two F1 thrusts with opposing vergence (northeast and southwest) that juxtapose rocks of different structural geometry. The orientation of pre-F2 mineral stretching lineations supports the model.

Chemically the volcanic rocks and associated gabbro sills of the Rankin Inlet Group plot in the tholeiitic basalt field in the alkali-silica, AFM, and Jensen cation diagrams. They straddle the boundary between high-iron and high-magnesium tholeiitic basalt fields. Whole rock, rare earth element (REE), and selected trace element analyses show no significant chemical differences between the lower and upper volcanic cycles. Rare earth element patterns show a slight lower rare earth element (LREE) enrichment which may suggest possible crustal contamination. A distinct compositional gap exists between the ultramafics and the tholeiitic basalts, which suggests that they are not genetically related. The ultramafic rocks are komatiitic and show LREE enrichment patterns similar to those of the tholeiitic basalts. The REE patterns of the tholeiitic basalts are similar to those of known Archean

tholeiites and may suggest similar source regions.

REFERENCES

Tella, S., Annesley, I.R., Borradaile, G.J. and Henderson, J.R., 1986. Precambrian geology of parts of Tavani, Marble Island and Chesterfield Inlet map areas, District of Keewatin, NWT; Geological Survey of Canada, Paper 86-13.

A LARGE ARCHEAN LAMPROPHYRE DYKE AT THE CON GOLD MINE, YELLOWKNIFE, NWT

D.R. Webb
University of Western Ontario

A large ultramafic lamprophyre dyke was emplaced into a major fracture subparallel to the gold-bearing Campbell shear zone at the Con Mine in Yellowknife. The intrusion can be traced discontinuously for 2100 m along strike and 1100 m down dip, and is locally up to 30 m thick. Granitic, gneissic, and volcanic xenoliths are present in concentrations up to 70% by volume, but generally account for <2% of the dyke. The lamprophyre is composed of variable amounts of coarse-grained panidiomorphic phlogopite and hornblende in a finer-grained assemblage of feldspar, dominantly orthoclase with some plagioclase, carbonate, quartz, chlorite, epidote, prehnite, apatite, rutile, and sulphides. The lamprophyre is characterized by low SiO (41.9 $\pm$ 1.8 wt. % 1σ), moderate alkalies (4.7 $\pm$ 2.1 wt. %) and K/Na=2.2 $\pm$ 1.6 1σ in common with calc-alkaline lamprophyres. Extensively enhanced abundances of LREE (LaCN=800) and other LIL-elements (Ba, Rb, Th, U, Zr, P), occur in conjuction with highly fractionated REE (LaCN/YbCN=80) and elevated compatable elements (Cr=606 ppm, Co=29 ppm, V=220 ppm, Ni=190 ppm). On extended chondrite normalized diagrams the lamprophyre possesses pronounced troughs at Nb, Ta, and Hf, Ti. This distinctive late phase of alkaline magmatism in the Yellowknife Greenstone Belt involves deep-crust upper mantle processes.

RECENT AGE-DATING ON THE GOLD-BEARING QUARTZ VEINS AT THE CON MINE, YELLOWKNIFE, NWT

D.R. WEBB AND R. KERRICH
UNIVERSITY OF WESTERN ONTARIO

The Yellowknife Mining District has produced over 11,000,000 ounces of gold from auriferous quartz veins hosted within Archean-aged tholeiitic mafic volcanics of the Kam Group. A granite batholith intrudes in the west, and a number of smaller granite stocks intrude within the volcanics. Incremental 40Ar/39Ar ages on muscovite from gold-bearing quartz veins from two stopes within the Con Mine yield dates of 2400 Ma and 2000 Ma. The 2400 Ma date is interpreted to be the age of formation (or blocking), and the 2000 Ma date is the age of a thermal disturbance. These dates correspond well to potassium-argon ages on biotite from the granite batholith to the west. Another felsic intrusive complex to the east yields the same 2400 Ma formation age but lacks the 2000 Ma reset on biotite. There are no known gold deposits peripheral to the eastern granite complex. It is thought that the gold deposits in Yellowknife are temporally-related to the Western Granodiorite complex, although no clear genetic relationship is recognized.

10:15 D. Wong/R. Kerrich, U. of W. Ont./ Con Mine — Recent age-dating on the gold bearing quartz veins at Con Mine, Yellowknife, NWT

10:30 COFFEE COURTESY AERO ARCTIC

10:45 G. Gaviglio, Golden Martin Res. — The Golden Martin program: Explorations in the south end of the Yellowknife volcanic belt

11:20 M. Strachan, R. Butler, Echo Bay Mines — Lupin Mine update

11:45 D. Wong, U. of W. Ont./ Con Mine — A large Archean lamprophyre dyke at Con Gold Mine, Yellowknife, NWT

12:00 LUNCH COURTESY NWT AIRLINES

CHAIR: Tony Shearcroft, Shearcroft Mining & Exploration Services Limited

1:20 V. Jackson, NWT Geology Division — A preliminary account of the geology around the north end of Russell Lake NTS (85O/4)

1:40 D. Bursnall, Akaitcho/ Carleton U. — Gold mineralization of the Bugow iron formation, District of Mackenzie, NWT

1:55 C. Stanley, Silver Hart Mines — Exploration and geology of the Pistol Lake iron formation hosted gold deposits

2:15 J. Ellis, Echo Bay Mines — Update on exploration of the Lex gold deposits, Indin Lake, NWT

2:35 COFFEE COURTESY AERO ARCTIC

2:55 V. Jackson, NWT Geology Division — Geology of the Hood River (Northeast part of NTS 76L)

3:10 W. Gibbins, R. Jones, NWT Geology Division — Geological Mapping, Hope Bay volcanic belt

3:30 W. Gibbins, NWT Geology Division — High magnesium peridotite from the Archean Hope Bay Greenstone Belt, NWT

3:50 J. McMillan, ISPG, Calgary — Fossil Forests, Arctic Islands

19:00 CHARLES CAMSELL GEOLOGICAL SOCIETY ANNUAL FESTIVITIES

SPEAKER: (20:00) Dr. J. McMillan, Institute of Sedimentary and Petroleum Geology, GSC, Calgary, A fossil forest Axel Heiburg Island

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THURSDAY, DECEMBER 4TH

CHAIR: Hayden Brown, Grant Yellowknife Mines

9:00 C. Relf, Memorial Univ./ NAP Geology — A Study of shear zone alteration in the "Mirage Islands Formation", Yellowknife Bay

9:25 K. Pelletier, NAP Geology Division — Geology of the northwest Mirage Islands, Yellowknife Bay, Great Slave Lake, District of Mackenzie, NWT

9:35 D. Powers Noranda Explo. Co. — Tundra - A Noranda Getty joint venture: Matthews-Courageous Lake Volcanic Belt.

10:05 COFFEE COURTESY AERO ARCTIC

10:15 S. Tella, T. Annesley, Lithosphere & Can. Shield Division, GSC — Structure and geochemistry of the Rankin Inlet Group, Rankin Inlet, NWT

10:40 B. Charbonneau, Mineral Res. Division, GSC — Radioactive granites of the Nueltin Lake area, NWT: geophysical signature and mineralization potential

11:00 J. Nikhani, Borealis Expl. — Gold exploration in the Keewatin District

11:25 D. Knowles, Nickel Peak Res. Ltd. — Happy Lake, base and precious metal targets in Rankin Ennadi Greenstone Belt

11:40 R. Freeman, Toponymist NWT Gov't — Toponymy, mapping and the Geologist: 44 years in Canada

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POSTER SESSIONS

Recent GSC Mapping NWT
1987 Mineral Related Programs in NWT B. Hildebrand

Recent NAP Geology Division Mapping NWT

Toponomy - NWT - R. Freeman, GNWT Toponymist

Lex Property - Echo Bay Mines

Core display, Specimens - from various NWT gold deposits - NAP

Glacial Lake Hood - D. Kerr (U. of Alberta/Ottawa U.), J.B. Seaton NAP Geology Division

Minident - U. of Alberta mineral identification program with on-line computer access to the U. of Alberta programs - D.G.W. Smith, L. de St. Jorre

Baseline geochemistry of tills, Victoria Island, NWT - Mark Nixon, GSC Terrain Sciences

The N-81 Ore body at Pine Point Mines - Sandra Foster, U. of Alberta

Ultramafic rocks of the NWT - possible sources of Platinum group metals
Walter Gibbins - DIAND

Permafrost thermal monitoring, Norman Wells Pipeline - M. Burgess, J.P. Pilon and K. MacInnes

PROGRAM---14TH ANNUAL GEOSCIENCE FORUM
KATIMAVIK ROOMS EXPLORER HOTEL, YELLOWKNIFE, DECEMBER 1-4 1986

OPENING SESSION, MONDAY DECEMBER 1
CHAIR: Pierre Laporte, NAP; Geology

1:00 WELCOME AND INTRODUCTION

Greetings from the City of Yellowknife:
His Worship Mayor McGrath

Greetings from the NWT Chamber of Mines:
Mr. Ken Blower, Manager, Giant Yellowknife Mines, Chairman of the NWT Chamber of Mines

Greetings from the Northern Affairs Program, DIAND:
Gilles Paternaude, Director, Minerals and Economic Analysis:

1:25 R. Thompson, Connors Drilling — Use of track vehicles in diamond drilling

1:50 B. MacLean, G. Vilks, G. Sonnichsen, Atlantic Geoscience Centre GSC — Studies of surficial sediments in inter island channels of the Canadian Arctic Archipelago.

2:15 COFFEE COURTESY AERO ARCTIC

2:30 C. Jefferson, Mineral Res. Division, GSC — Non-renewable resource assessments in Wager Bay-Southampton Island and South Nahanni River Areas - A progress report

2:55 K. Dawson, Mineral Res. Division, GSC — Preliminary metallogenic resource evaluation of proposed Nahanni National Park extension, Ragged Ranges, NWT

3:20 L. de St. Jorre, Hardwood Res. / U. of Alberta — Economic mineralogy of the north T-Zone Deposit Thor Lake, NWT

3:45 D. Clarkson Gov't NWT — Bear deterrent in camp setting

4:05 A. Clark, LMR, Mineral Policy — A mineral development agreement for the NWT

19:00 COCKTAILS 20:00 CIMM DINNER
SPEAKER: Hayden Brown — "A day in the life of a Geologist in the high Arctic".

TUESDAY, DECEMBER 2ND
CHAIR: Michael Cunningham, Giant Yellowknife Mines

9:00 R. Hildebrand, Lithosphere and Canadian Shield Division, GSC — Processes in subvolcanic magma chambers: Implications for the genesis of ore deposits

9:25 T. Riecherbach, Carleton U./ NWT Geology Division — An ensialic marginal basin in Wopmay Orogen

9:55 K. Pelletier, Carleton U./ NAP Geology Division — Early Proterozoic Ellington volcanic-sedimentary complex of the Great Bear magmatic zone, Wopmay Orogen, District of Mackenzie, NWT: Roots of an ancient caldera

10:10 COFFEE COURTESY AERO ARCTIC

10:35 M. Sawiuk, R. Gosse CEGB — Sediment-hosted stratabound copper and uranium mineralization in the Bear Province

10:55 R. Cullen, U. of Ottawa NAP Geology Division — Structure of the Cameron River volcanic belt, Fenton Lake area

11:15 T. Kusky, Johns Hopkins U. — Basement supracrustal relations Cameron River and Point Lake areas

12:00 CHAMBER LUNCHEON and ANNUAL GENERAL MEETING

2:00 LAND CLAIMS AND RESOURCE DEVELOPMENT
Panel Session, organized by NWT Chamber of Mines: Introduction - D. Nutter
Moderator: Ewan Cotterill

Panel:
- GNWT (Aboriginal Rights and Constitutional Development Secretariat - Charles Dewhold
- Dene Metis Negotiations Secretariat
- Tunngavik Federation of Nunavut (Bob Kadlun, Chief Negotiator)
- Canadian Petroleum Association - Paul Atkinson (Esso Resources)
- The Canadian Institute of Resource Law Constance Hunt, Executive Director

4:40 - 6:40 FORUM SQUASH TOURNAMENT
YK Racquet Club - sponsored by Freeport McMoRan Gold Co.

CHAMBER OF MINES ANNUAL DINNER, Caribou Room, Yellowknife Inn
18:30 CASH BAR 19:00 DINNER - Cost $35.00
Speaker: Brian Lewis (Northern Anecdotes)

WEDNESDAY, DECEMBER 3RD

9:00 GOLD IN THE SLAVE PROVINCE
CHAIR: Walter A. Gibbins, NAP; Geology

9:05 W. Tyson, U. Of Ottawa — The habit and timing of quartz veins relative to folds and cleavages in the Yellowknife supracrustal domain

9:25 J. Brouly, NAP Geology Division — Turbidite hosted gold quartz veins in the Yellowknife Supracrustal Basin

9:50 S. Swatton, U. of Alberta/ Terra Mine — The structure and mineralogy of the Bullmoose Lake Gold Deposit

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